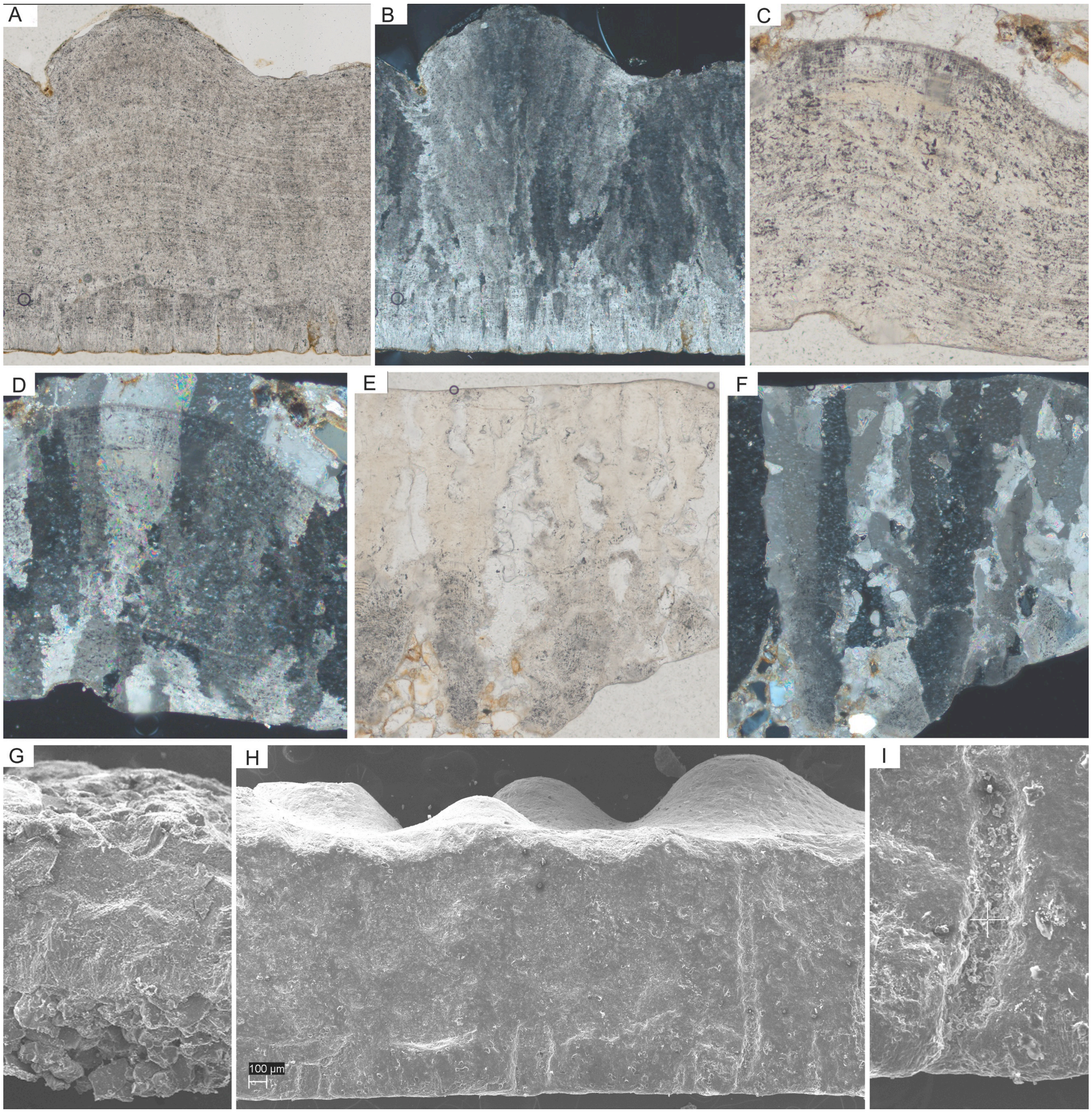
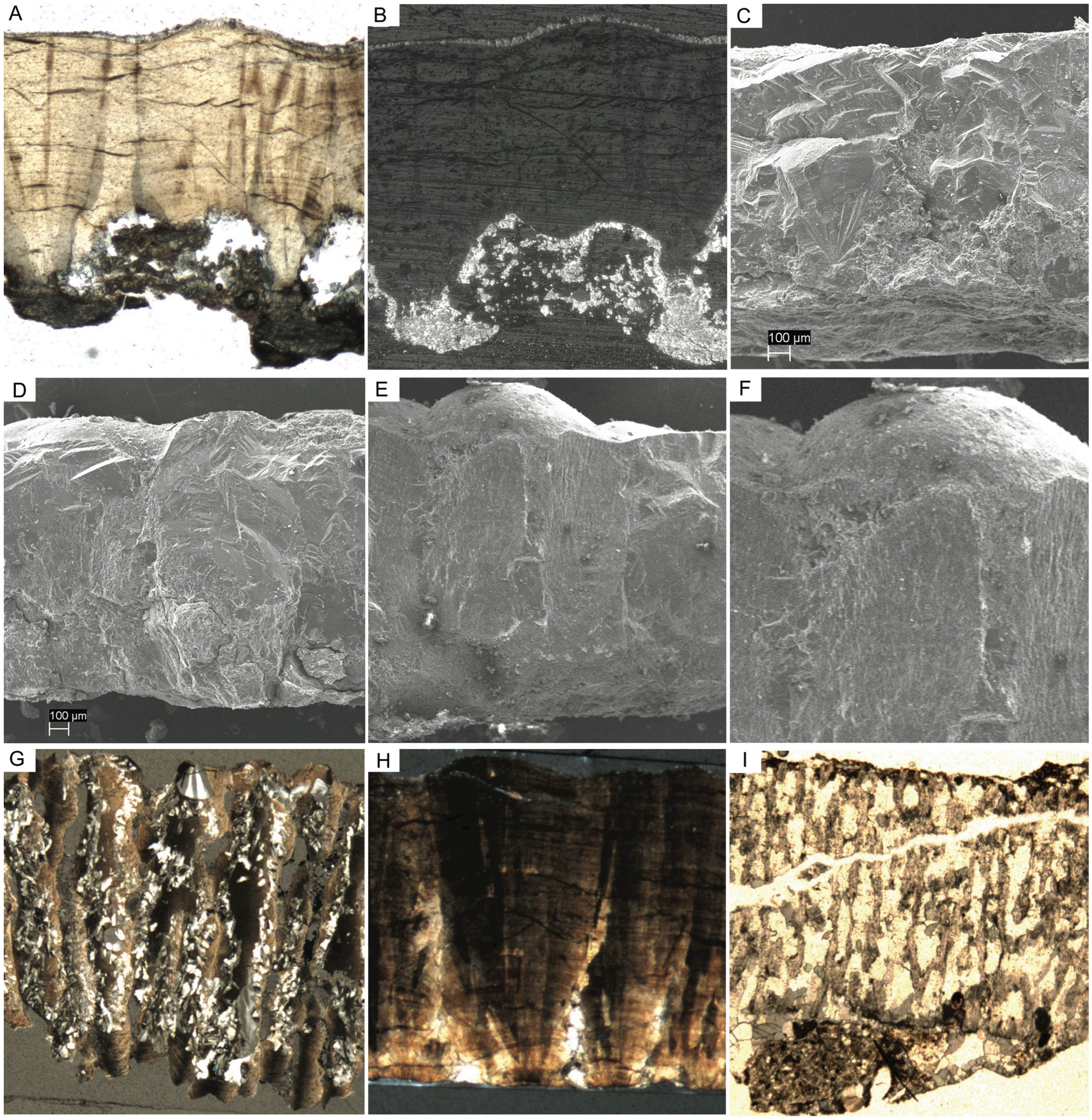
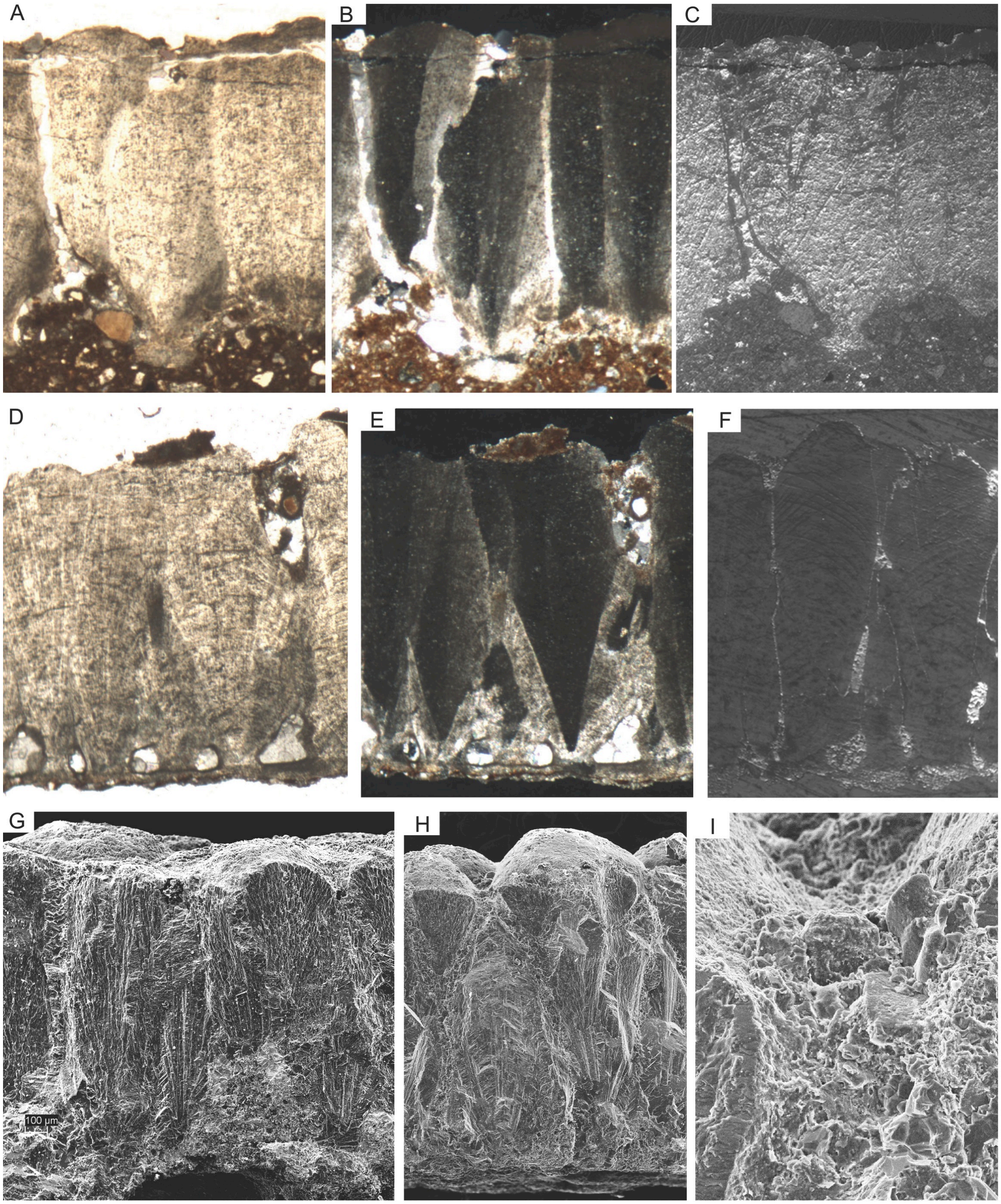


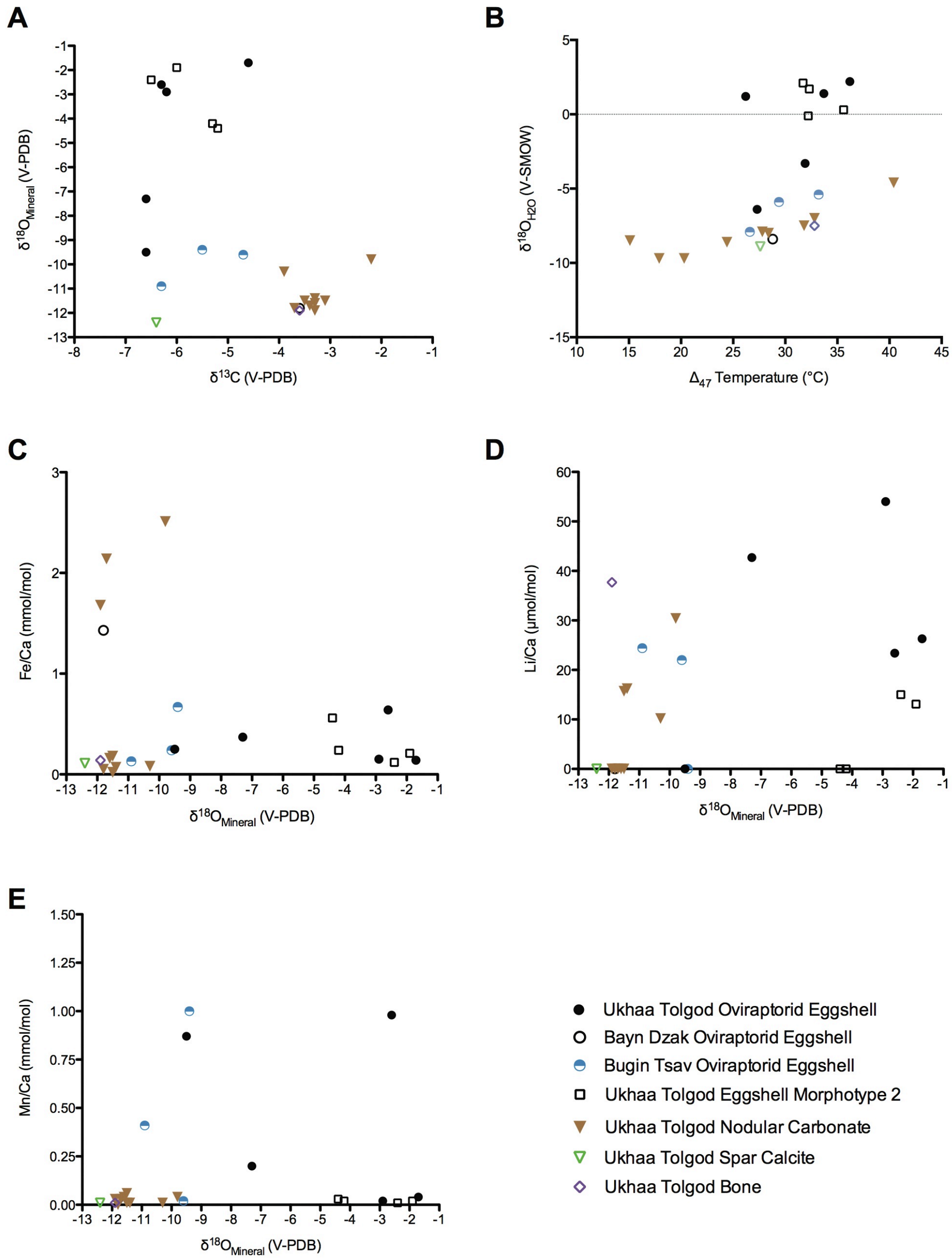
Supplementary Figure 1. Representative petrographic images of specimens from Mongolia. Eggshells are 0.7 to 1.6 mm thick. Panels A-D are typical transmitted and polarized light images of oviraptorid eggshells from Ukhaa Tolgod. A-B illustrate an apparently well preserved specimen. C-D illustrate a sample with two layers of structural calcite, an outer layer with some quartz sand grains adhering to the eggshells illustrating that some alteration of the very outer surface of the eggshell might have occurred, at which point sand grains may have attached. We expect that this outer surface would have been removed during the drilling protocol used. E-F are typical images of a Djadokhta Morphotype 2 eggshell. The transmitted light shows light areas within the main eggshell structure which are indicative of areas of dissolution and replacement, which is also seen in the polarized light image. This is the primary reason for considering these specimens as uncertain of poor preservation. Cathodoluminescence images of Mongolian eggshells are not shown, as there was no significant florescence in any of the samples examined. Panels G-I show SEM images of oviraptorid eggshells. Panel G shows a specimen with large grains attached to its interior surface. These are shown to be quartz sand grains by EDS analysis and are removed by drilling before analysis. H and I show a specimen displaying apparently excellent preservation with little evidence for dissolution on the outer surface evidenced by prominent eggshell surface features. This cross section also illustrates an important feature of this eggshell type, namely that pore canals such as the one evident are small and rare, so do not act as focal points for dissolution and secondary mineral precipitation. Panel I is a close up of the pore canal which is found not to have been infilled with secondary material or host matrix.



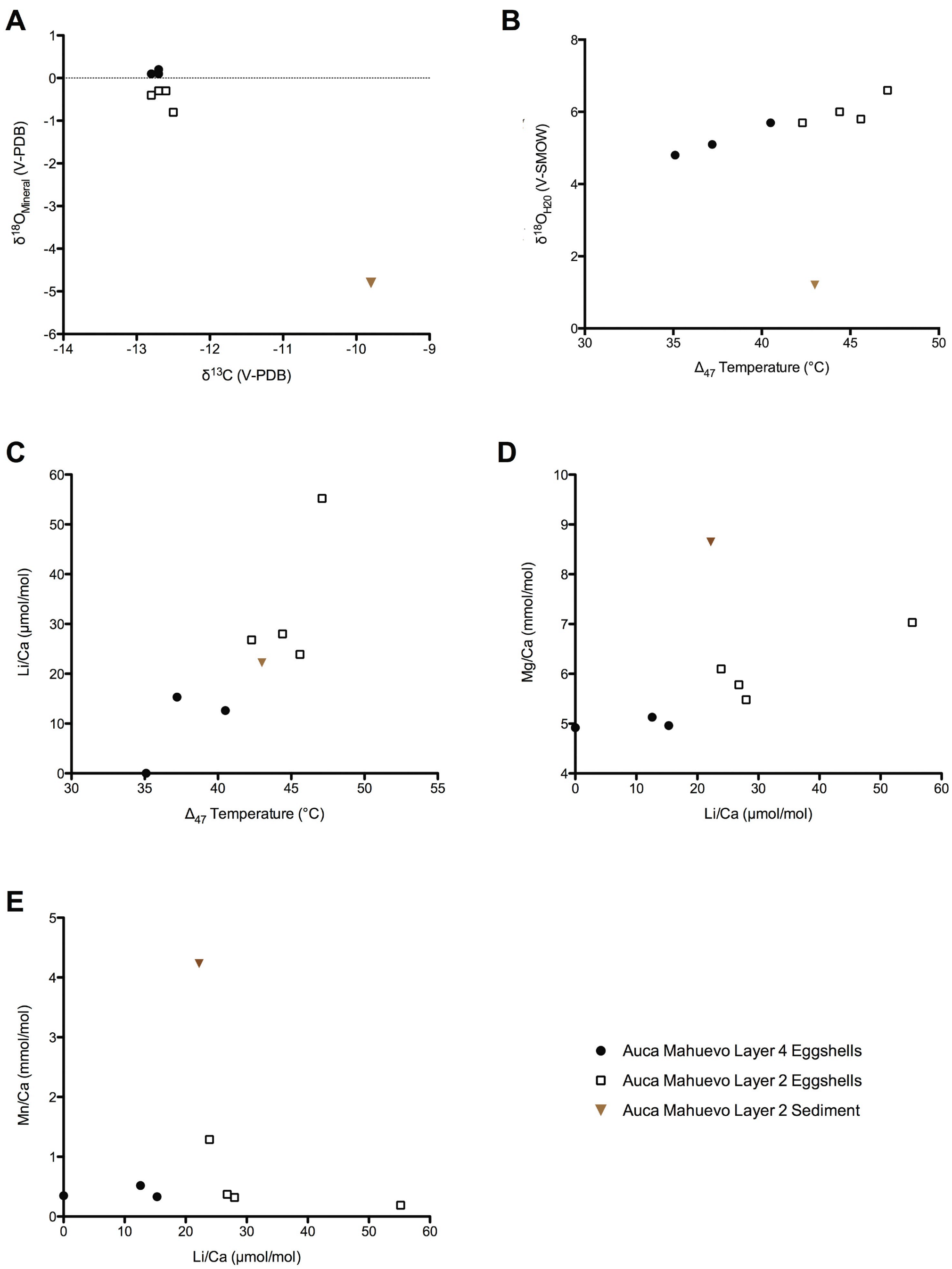
Supplementary Figure 2. Representative petrographic images of specimens from Argentina and other sites. Eggshells are 1 to 2 mm thick. Panels A-F are images of Auca Mahuevo eggshells. Panel A and B show thin section transmitted light and cathodoluminescence images of typical egg-bearing layer 2 eggshells. Substantial dissolution and reprecipitation of carbonate on the eggshell inner surface is apparent, particularly surrounding calcite nucleation centers. On the outer surface dissolution and reprecipitation is still apparent but not as extensive as the inner layer. Panels C-D are SEM images of a layer 2 eggshell showing extensive blocky calcite on the inner eggshell surface. Panel E and F are SEM images of a typical layer 4 eggshell. Surface ornamentation is noticeably more prominent than in the layer 2 specimen and blocky calcite also less apparent. Panel F represents a higher magnification image of a pore canal opening shown in E. Blocky material at the entrance to pore canals was revealed to be silica rich clay minerals rather than secondary calcite by EDS analysis. Panel G is a polarized light image of a thin section of a Faveolithid eggshell from Rio Negro Argentina showing extensive evidence for dissolution and replacement/recrystallization. Panel H is a polarized light image of an eggshell from the Two Medicine formation in Montana that has been described as being of the parataxonomic group Spheroolithidae. In this case the eggshell is more intact but pore canals are infilled with calcium carbonate, which is fluorescent under CL (not shown). Panel I is a transmitted light image of a Megaloolithid eggshell from Ningxia in Mongolia, also showing extensive evidence for diagenesis and replacement.



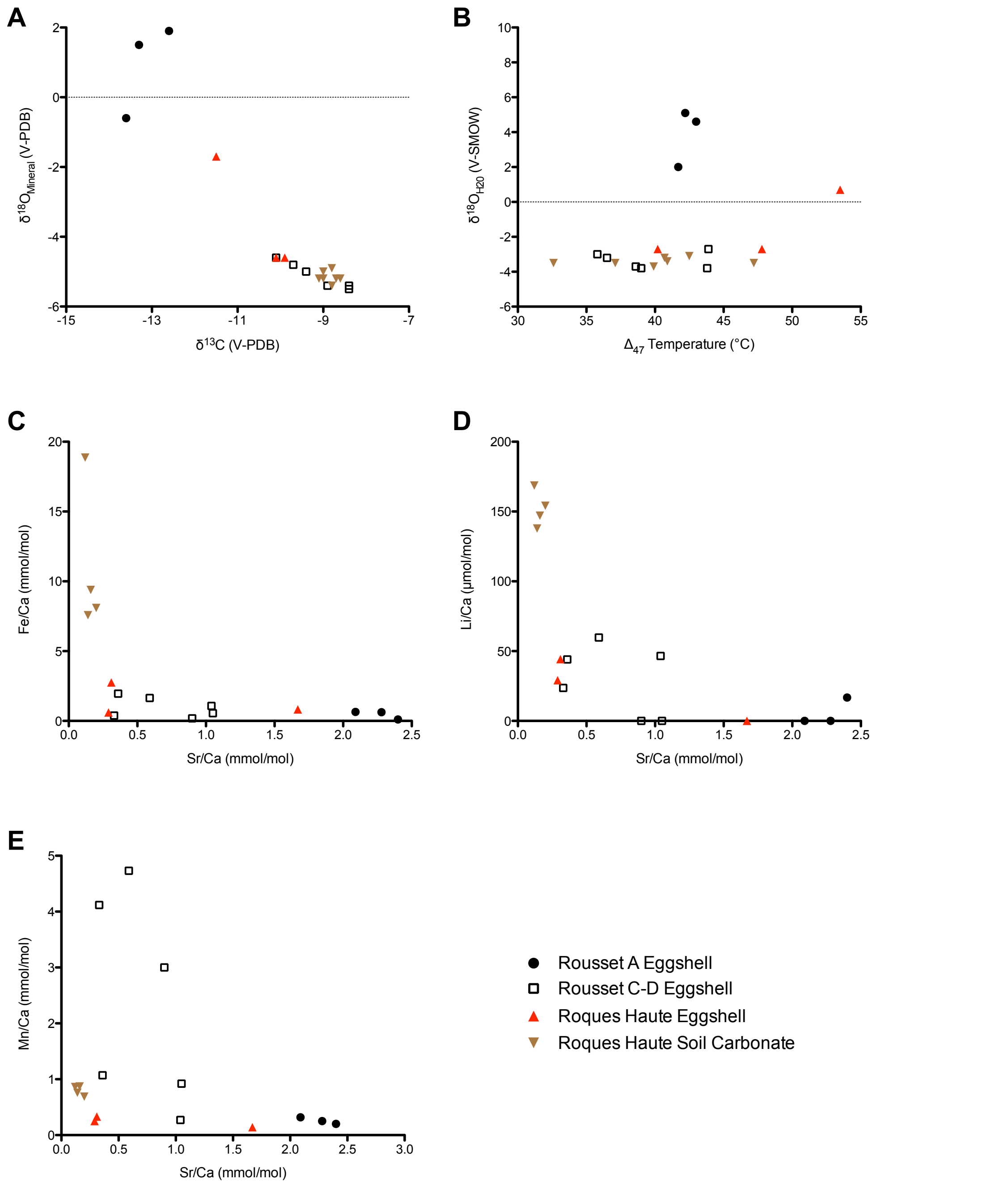
Supplementary Figure 3. Representative petrographic image of specimens from France. Eggshells are typically 1.2 to 2 mm thick. Panels A-C show transmitted light, polarized light and cathodoluminescence images of a Rousset level B eggshell. Cathodoluminescence reveals pervasive alteration of this specimen. Specimens showing high levels of fluorescence like this are in the minority at Rousset. Panels D-F is a more typical example of a Rousset eggshell (including level A), with analysis of thin sections showing clear evidence for secondary carbonate precipitation localized to pore canals and the very outer surface of the eggshell but not the main structure of the eggshell. Panels G and H are SEM images of Rousset level B and A eggshell respectively. Blocky (presumably secondary) carbonate is visible around pore canal openings and on the underside of the eggshell in the level B specimen in particular. However eggshell structural features appear intact. Panel I is a higher magnification image of the pore canal opening in Panel H. Blocky material infilling the pore canal is identified as carbonate by EDS analysis.



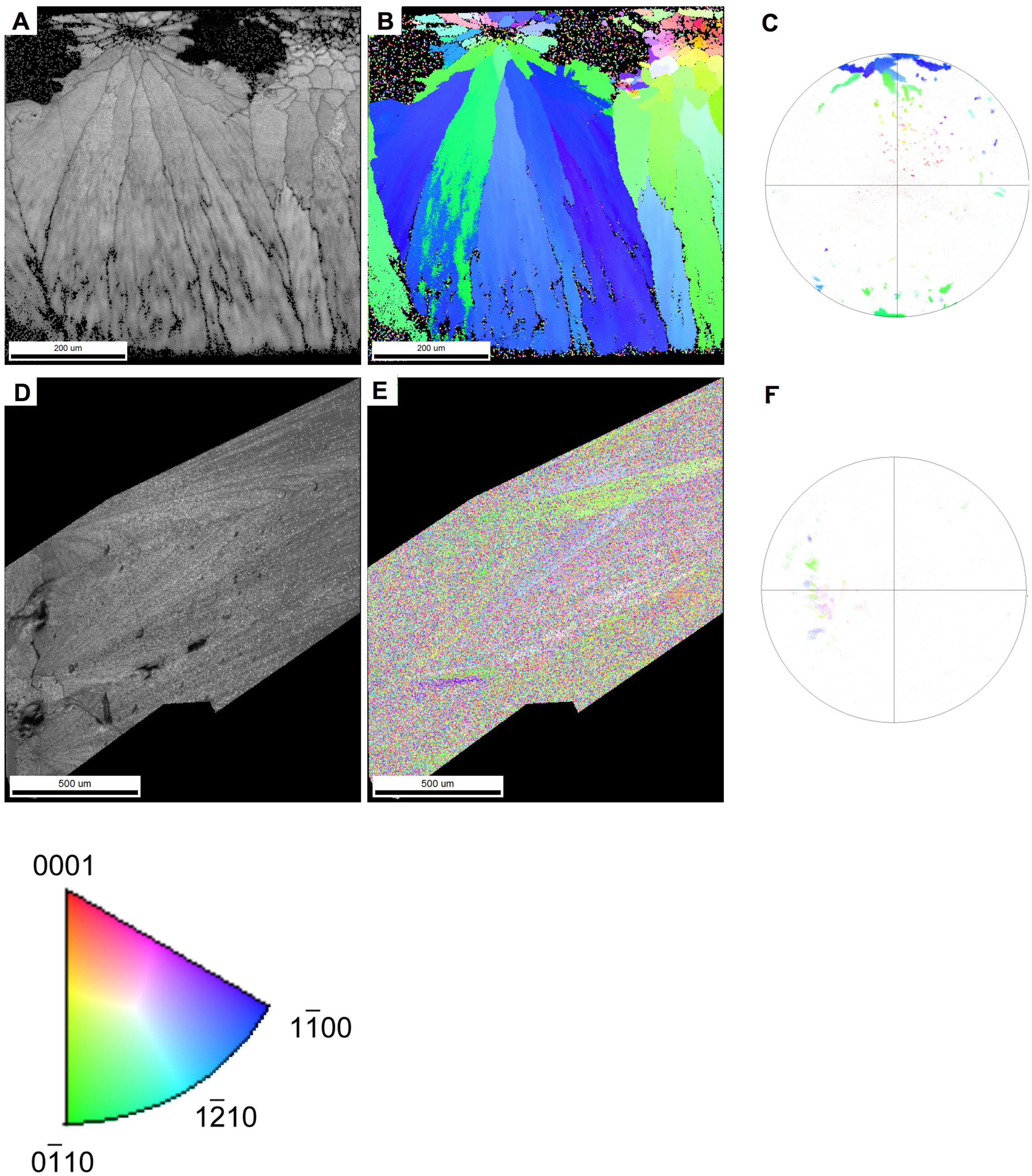
Supplementary Figure 4. Trace element and isotopic composition of material from Mongolia. Panels A and B show stable isotope data for all Mongolian samples and illustrate the separation of carbonate nodules and diagenetic phases from some, but not all eggshells. Oviraptorid eggshells with stable isotopic compositions approaching those of carbonate nodules, spar calcite, and bone. Δ_{47} temperatures in this plot are calculated using the Caltech calibration line for biogenic carbonate that is slightly shallower than the Ghosh et al. inorganic calibration[25,30]. Panels C-E illustrate that at this site there is no strong correlation between trace element contents and the wide range in oxygen isotope compositions of materials at this site and we take this to be an indication that trace element content is not providing strong indications of preservation/diagenesis at this site.



Supplementary Figure 5. Trace element and isotopic composition of material from Argentina. Panels A and B illustrate that Auca Mahuevo layer 2 eggshells are only marginally different in bulk isotopic composition than layer 4 eggshells and both are very different from measurements made on bulk sediment from the site. However Δ_{47} temperatures are significantly higher in layer 2 eggshells. Panel C shows that a strong correlation exists between Δ_{47} temperature and Li/Ca in Auca Mahuevo samples, a possible indication that lithium contents may be indicative of eggshell recrystallization in layer 2 specimens. Eggshell specimens that are higher in lithium are also higher in magnesium although manganese appears to be less diagnostic, as shown in panels D-E.



Supplementary Figure 6. Trace element and isotopic composition of material from France. Panels A and B illustrate that eggshells from Roques Hautes and Rousset levels C-D all have very similar isotopic compositions to soil carbonates. In contrast, Rousset A eggshells clearly are distinct in their composition compared to soil carbonates. Panels C-E illustrate that Rousset A specimens are higher in strontium than other materials, but generally lower in manganese and lithium, and marginally lower in iron. This pattern could potentially be consistent with loss of strontium but gain of other elements due to diagenesis of eggshells. However it could also represent different modes of alteration in different stratigraphic layers, an interpretation favored by petrographic and EBSD analysis (Supplementary Note 3, Supplementary Figure 4, Supplementary Figure 7).



Supplementary Figure 7. EBSD analysis of Rousset eggshells. This analysis proved instructive in interpreting Rousset eggshell geochemistry, with Rousset level A eggshells clearly completely recrystallized (D-F). Rousset C-D eggshells yielded a very mixed picture with some specimens showing excellent preservation, such as the one indicated here in the upper panels (A-C). However other eggshells were clearly altered, for example those shown in Supplementary Figure 3.

Supplementary Table 1. Compatibility of modern eggshell Δ_{47} data with different Δ_{47} – temperature calibrations showing that accurate values are determined using the Ghosh et al. (2006) inorganic calcite calibration converted onto the absolute reference frame (Equation 2), the Caltech biogenic carbonate compilation (Equation 3) calibration, and the Zaarur et al. (2013) synthetic calibration. In contrast, the shallower sloped calibrations for inorganic carbonate yield inaccurate results so were not applied to ancient specimens. All clumped isotope values are on absolute reference frame. Expected body temperatures are from literature cited in Supplementary References.

				Steep slope calibrations				Shallow slope calibrations	
				Δ_{47} (Biogenic)	Δ_{47} (1 s.e.)	Δ_{47} (Inorganic - Ghosh)	Δ_{47} (Inorganic - Zaarur)	Δ_{47} (Inorganic - Tang)	Δ_{47} (Inorganic - Defliese)
Species	**Common name**	**type**	**Expected temperature**	**T (°C)**	**T (°C)**	**T (°C)**	**T (°C)**	**T (°C)**	**T (°C)**
Pipilo erythrophtalmus	Eastern towhee	bird	43.3	45.3	0.6	45.4	47.0	50.8	55.5
Sayornis phoebe	Eastern phoebe	bird	43.3	44.4	3.4	44.7	46.1	49.5	54.1
Vanellus miles	Masked lapwing	bird	42.0	37.5	1.3	38.5	38.8	39.1	42.9
Gallus gallus domesticus	Domestic chicken	bird	41.5	41.3	2.2	41.9	42.8	44.8	49.0
Odontophorus melanotis	Wood quail	bird	41.5	40.8	1.4	41.4	42.2	44.0	48.1
Irena puella	Asian fairy bluebird	bird	41.0	40.2	0.8	40.9	41.7	43.2	47.2
Columba livia	Rock pigeon	bird	41.0	41.1	0.8	41.7	42.5	44.4	48.6
Cathartes aura	Turkey Vulture	bird	39.9	37.5	2.9	38.5	38.8	39.1	42.9
Struthio camelus	Common Ostrich	bird	39.1	39.4	0.5	40.2	40.8	41.9	45.9
Cygnus atratus	Black swan	bird	39.0	38.6	3.5	39.5	40.0	40.7	44.6
Tyto alba	Barn owl	bird	38.7	40.8	3.3	41.4	42.2	44.0	48.1
Dromaius novaehollandiae	Emu	bird	38.0	36.2	1.8	37.3	37.4	37.2	40.8
Spheniscus magellanicus	Magellanic penguin	bird	37.8	39.4	3.0	40.2	40.8	41.9	45.9
Varanus gouldii	Monitor lizard	reptile	33.5-36.3	31.3	11.0	33.0	32.3	30.1	33.2
Geochelone radiata	Radiated tortoise	reptile	31-34	33.3	2.5	34.8	34.5	33.0	36.3
Alligator mississippiensis	American alligator	reptile	29-33	29.5	0.2	31.4	30.5	27.6	30.5
Crocodylus acutus	American crocodile	reptile	29-33	31.3	1.8	33.0	32.3	30.1	33.2
Chelonoidis nigra	Galapagos giant tortoise	reptile	28-32	32.8	1.8	34.3	33.9	32.3	35.5
Podocnemis sp.	Turtle	reptile	28-32	29.8	1.7	31.6	30.8	28.0	30.9
Pantherophis guttatus	Corn snake	reptile	27-29	30.0	2.2	31.8	31.0	28.3	31.3
Crocodylus niloticus	Nile crocodile	reptile	27-28	27.6	1.7	29.6	28.5	24.8	27.5
Heloderma horridum exasperatum	Beaded lizard	reptile	26-30	31.5	2.3	33.2	32.6	30.5	33.6

Supplementary Table 2. Stable isotope and trace element data from individual modern eggshell specimens

Sample ID	Species/Material	# Analyses	$\delta^{13}C$ ‰ (V-PDB)	$\delta^{13}C$ 1 S.D.	$\delta^{18}O$ ‰ (V-PDB)	$\delta^{18}O$ 1 S.D.	Δ_{47} ‰, ARF	Δ_{47} 1 S.E.	Δ_{47} Temp (C) (Biogenic Eq.)	Δ_{47} Temp (C) (Ghosh Eq.)	Δ_{47} Temp (C) (Zaarur Eq.)	$\delta^{18}O$ (water) ‰ (V-SMOW)	Fe/Ca mmol/mol	Li/Ca µmol/mol	Mg/Ca mmol/mol	Mn/Ca mmol/mol	Sr/Ca mmol/mol
Eastern towhee	*Pipilo erythrophtalmus*	2	-13.9	0.0	-4.6	1.4	0.622	0.002	45.3	45.4	47.0	0.6					
Eastern phoebe	*Sayornis phoebe*	1	-13.6	0.0	-1.1	0.0	0.625	0.012	44.4	44.7	46.1	3.4					
Masked lapwing	*Vanellus miles*	3	-3.9	0.0	-2.8	1.2	0.650	0.005	37.5	38.5	38.8	1.3					
Domestic chicken	*Gallus gallus domesticus*	2	3.3	0.3	-4.6	0.4	0.636	0.008	41.3	41.9	42.8	2.2					
Wood quail	*Odontophorus melanotis*	2	-3.1	0.1	-1.2	0.1	0.638	0.005	40.8	41.4	42.2	1.4					
Asian fairy bluebird	*Irena puella*	2	-8.7	0.0	-0.6	0.0	0.640	0.003	40.2	40.9	41.7	0.8					
Rock pigeon	*Columba livia*	4	-3.0	0.2	-1.7	1.0	0.637	0.003	41.1	41.7	42.5	0.8					
Turkey Vulture	*Cathartes aura*	2	-9.5	0.0	-4.5	0.1	0.650	0.011	37.5	38.5	38.8	2.9					
Common Ostrich	*Struthio camelus*	3	-12.6	0.0	-3.9	0.0	0.643	0.002	39.4	40.2	40.8	0.5	0.00	0.6	5.8	0.00	0.3
Black swan	*Cygnus atratus*	4	-5.1	0.1	-11.3	0.3	0.646	0.013	38.6	39.5	40.0	3.5	0.01	2.0	9.2	0.00	0.7
Barn owl	*Tyto alba*	4	-16.1	0.2	-3.1	0.3	0.638	0.012	40.8	41.4	42.2	3.3					
Emu	*Dromaius novaehollandiae*	3	-8.3	0.2	-14.3	0.4	0.655	0.007	36.2	37.3	37.4	1.8					
Magellanic penguin	*Spheniscus magellanicus*	5	-11.4	0.1	-7.5	0.3	0.643	0.011	39.4	40.2	40.8	3.0					
Monitor lizard	*Varanus gouldii*	2	-13.6	0.1	-3.0	0.0	0.674	0.046	31.3	33.0	32.3	11.0					
Radiated tortoise	*Geochelone radiata*	3	-14.7	0.1	-5.4	0.0	0.666	0.010	33.3	34.8	34.5	2.5					
American alligator	*Alligator mississippiensis*	3	-13.4	0.0	-16.6	0.0	0.681	0.001	29.5	31.4	30.5	0.2					
American crocodile	*Crocodylus acutus*	4	-12.5	0.0	-3.8	0.1	0.674	0.007	31.3	33.0	32.3	1.8					
Galapagos giant tortoise	*Chelonoidis nigra*	2	-16.5	0.0	-8.6	1.6	0.668	0.007	32.8	34.3	33.9	1.8					
Turtle	*Podocnemis sp.*	4	-14.5	0.1	-5.4	0.2	0.680	0.007	29.8	31.6	30.8	1.7					
Corn snake	*Pantherophis guttatus*	4	-10.4	0.0	-4.6	0.1	0.679	0.009	30.0	31.8	31.0	2.2					
Nile crocodile	*Crocodylus niloticus*	3	-9.2	0.1	-2.5	0.2	0.689	0.007	27.6	29.6	28.5	1.7					
Beaded lizard	*Heloderma horridum exasperatum*	1	-8.9	0.0	-0.2	0.0	0.673	0.009	31.5	33.2	32.6	2.3					

*Measurements combined from different splits of the same eggshell, hence largers S.D. and S.E. may be apparent

Δ_{47} values are given on the absolute reference frame (ARF).

Supplementary Table 3. Stable isotope and trace element data from individual ancient eggshell specimens

Sample ID	Species/Material	Locality	# Analyses	$\delta^{13}C$ ‰ (V-PDB)	$\delta^{13}C$ 1 S.D.	$\delta^{18}O$ ‰ (V-PDB)	$\delta^{18}O$ 1 S.D.	Δ_{47} ‰, ARF	Δ_{47} 1 S.E.	Δ_{47} Temp (C) (Biogenic Eq.)	Δ_{47} Temp (C) (Ghosh Eq.)	Δ_{47} Temp (C) (Zaarur Eq.)	$\delta^{18}O$ (water) ‰ (V-SMOW)	Fe/Ca mmol/mol	Li/Ca μmol/mol	Mg/Ca mmol/mol	Mn/Ca mmol/mol	Sr/Ca mmol/mol
Auca Mahuevo Samples:																		
7_1 (7)	Titanosaurid	Auca Mahuevo, Level 2	2	-12.5	0.0	-0.5	0.0	0.621	0.001	45.6	45.6	47.2	5.8	0.04	23.9	6.10	1.29	3.35
7_2 (8)	Titanosaurid	Auca Mahuevo, Level 2	3	-12.6	0.1	0.0	0.0	0.633	0.004	42.3	42.7	43.8	5.7	0.02	26.8	5.78	0.37	3.48
7_3 (9)	Titanosaurid	Auca Mahuevo, Level 2	2	-12.8	0.0	-0.1	0.0	0.625	0.005	44.4	44.6	46.0	6.0	0.02	28.0	5.48	0.32	3.56
12	Titanosaurid	Auca Mahuevo, Level 2	1	-12.7	0.0	0.0	0.0	0.616	0.012	47.1	47.0	48.9	6.6	0.33	55.2	7.03	0.19	3.11
AM Sediment	Bulk Sediment	Auca Mahuevo, Level 2	2	-12.7	0.0	0.4	0.1	0.659	0.001	35.1	36.4	36.3	4.8	4.36	22.2	8.65	4.23	1.17
AUCA L4 16	Titanosaurid	Auca Mahuevo, Level 4	2	-12.8	0.0	0.3	0.0	0.651	0.000	37.2	38.3	38.6	5.1	0.09	0.0	4.92	0.35	3.13
AUCA L4 17	Titanosaurid	Auca Mahuevo, Level 4	3	-12.7	0.1	0.4	0.1	0.639	0.003	40.5	41.2	42.0	5.7	0.07	15.3	4.96	0.33	3.12
AUCA L4 18	Titanosaurid	Auca Mahuevo, Level 4	1	-9.8	0.0	-4.6	0.0	0.630	0.007	43.0	43.4	44.6	1.2	0.13	12.6	5.13	0.52	3.11
Provence Basin Samples:																		
5	Putative titanosaurid	Ariège	3	-10.3	0.0	-3.1	0.0	0.659	0.010	35.0	33.0	36.2	1.2	0.6	0.02	3.6	5.06	0.15
3*	Putative titanosaurid	Rousset, Level A	4	-13.6	0.2	-0.4	0.2	0.635	0.002	41.6	38.9	43.1	5.2	0.11	16.8	7.40	0.20	2.40
Rousset A1	Putative titanosaurid	Rousset, Level A	1	-12.6	0.0	2.2	0.0	0.633	0.009	42.2	39.3	43.8	7.9	0.65	0.0	10.86	0.32	2.09
Rousset A2	Putative titanosaurid	Rousset, Level A	1	-13.3	0.0	1.8	0.0	0.630	0.009	43.0	40.0	44.6	7.6	0.63	0.0	6.68	0.25	2.28
Rousset B1	Putative titanosaurid	Rousset, Level B	2	-8.4	0.0	-5.2	0.0	0.644	0.001	39.0	36.5	40.4	-0.1	1.95	44.1	13.34	1.07	0.36
Rousset B2	Putative titanosaurid	Rousset, Level B	1	-8.9	0.0	-5.1	0.0	0.646	0.006	38.6	36.1	39.9	-0.1	1.65	59.7	19.37	4.73	0.59
Rousset C1	Putative titanosaurid	Rousset Level C	1	-8.4	0.0	-5.2	0.0	0.627	0.012	43.8	40.7	45.4	0.8	0.39	23.6	13.03	4.12	0.33
Rousset C2	Putative titanosaurid	Rousset Level C	1	-9.4	0.0	-4.7	0.0	0.654	0.007	36.5	34.3	37.8	-0.1	0.18	0.0	6.45	3.00	0.90
Rousset D1	Putative titanosaurid	Rousset Level D	1	-9.7	0.0	-4.5	0.0	0.656	0.013	35.8	33.7	37.1	-0.1	1.07	46.5	10.71	0.27	1.04
Rousset D2	Putative titanosaurid	Rousset Level D	1	-10.1	0.0	-4.3	0.0	0.627	0.008	43.9	40.8	45.4	1.7	0.55	0.0	12.43	0.92	1.05
FR94_031_RH.1 (ES)	Putative titanosaurid	Roques Hautes	2	-11.5	0.0	-1.5	0.1	0.595	0.005	53.5	49.2	55.5	6.2	0.83	0.0	9.76	0.14	1.67
FR94_01_RH.2 (ES)	Putative titanosaurid	Roques Hautes	2	-9.9	0.3	-4.3	0.0	0.613	0.004	47.8	47.6	49.6	2.4	0.60	29.1	6.79	0.25	0.29
FR94_031_RH.3 (ES)	Putative titanosaurid	Roques Hautes	2	-10.1	0.0	-4.3	0.1	0.640	0.014	40.2	40.9	41.7	1.0	2.75	44.3	9.98	0.33	0.31
FR94_032_RH.1	Carbonate nodule	Roques Hautes	1	-8.6	0.0	-4.9	0.0	0.615	0.004		43.7	49.0	1.0	8.09	154.2	17.68	0.69	0.20
FR94_032_RH.2	Carbonate nodule	Roques Hautes	1	-9.0	0.0	-4.9	0.0	0.652	0.007		34.8	38.4	-0.6					
FR94_035_RH.2	Carbonate nodule	Roques Hautes	1	-8.8	0.0	-4.6	0.0	0.632	0.013		39.6	44.1	0.6	7.58	137.9	14.71	0.76	0.14
FR94_036_RH.1	Carbonate nodule	Roques Hautes	1	-9.1	0.0	-4.9	0.0	0.638	0.010		38.1	42.3	0.0	9.38	147.0	17.37	0.87	0.16
FR_94_036_RH.2	Carbonate nodule	Roques Hautes	1	-9.0	0.0	-4.7	0.0	0.638	0.012		38.0	42.1	0.2					
FR94_040_RH.1	Carbonate nodule	Roques Hautes	1	-8.8	0.0	-5.1	0.0	0.641	0.012		37.3	41.3	-0.3	18.86	168.7	17.82	0.86	0.12
FR_94_040_RH.2	Carbonate nodule	Roques Hautes	1	-8.7	0.0	-5.0	0.0	0.669	0.017		34.1	33.7	-0.8					
Mongolian Samples:																		
IGM 100/1189	Oviraptorid	Bugin Tsav, Nemegt	4	-6.3	0.1	-10.6	0.2	0.693	0.002	26.6	28.8	27.5	-7.9	0.13	24.4	4.97	0.41	1.18
B. Tsav Egg	Oviraptorid	Bugin Tsav, Nemegt	1	-4.7	0.0	-9.3	0.0	0.666	0.015	33.2	34.7	34.4	-5.4	0.24	22.0	5.04	0.02	0.83
BB08 Egg	Oviraptorid	Bugin Tsav, Nemegt	2	-5.5	0.1	-9.2	0.1	0.681	0.004	29.4	31.3	30.4	-5.9	0.67	0.0	7.00	1.00	1.42
IGM 100/1150	Oviraptorid	Bayn Dzak, Djadokhta Fm.	2	-3.6	0.1	-11.5	0.2	0.684	0.014	28.8	30.8	29.8	-8.4	1.43	0.0	5.84	0.03	2.26
IGM 100/1188	Oviraptorid	Ukhaa Tolgod, Djadokhta Fm.	4	-6.6	0.0	-9.2	0.2	0.690	0.009	27.3	29.4	28.2	-6.4	0.25	0.0	4.46	0.87	1.04
Partial Egg	Oviraptorid	Ukhaa Tolgod, Djadokhta Fm.	4	-6.6	0.1	-7.0	0.3	0.672	0.011	31.9	33.5	33.0	-3.3	0.37	42.7	2.39	0.20	1.47
UT03	Oviraptorid	Ukhaa Tolgod, Djadokhta Fm.	4	-6.2	0.1	-2.7	0.1	0.664	0.023	33.7	35.2	34.9	1.4	0.15	54.0	2.53	0.02	2.59
UT13	Oviraptorid	Ukhaa Tolgod, Djadokhta Fm.	2	-6.3	0.2	-2.3	0.5	0.655	0.009	36.2	37.3	37.4	2.2	0.64	23.4	5.99	0.98	1.38
Loose shell frag.	Oviraptorid	Ukhaa Tolgod, Djadokhta Fm.	3	-4.6	0.0	-1.5	0.4	0.695	0.004	26.2	28.4	27.0	1.2	0.14	26.3	1.51	0.04	2.70
IGM 100/1062	Djadokhta mophotype 2	Ukhaa Tolgod, Djadokhta Fm.	4	-5.2	0.2	-4.2	0.3	0.657	0.012	35.6	36.8	36.8	0.3	0.56	0.0	7.72	0.03	1.99
IGM 100/1063	Djadokhta mophotype 2	Ukhaa Tolgod, Djadokhta Fm.	3	-5.3	0.4	-4.0	0.5	0.670	0.010	32.2	33.8	33.3	-0.1	0.24	0.0	5.82	0.02	3.98
IGM 100/1066	Djadokhta mophotype 2	Ukhaa Tolgod, Djadokhta Fm.	2	-6.5	0.2	-2.1	0.5	0.670	0.005	32.3	33.9	33.4	1.7	0.12	15.0	4.10	0.01	5.43
IGM 100/1060	Djadokhta mophotype 2	Ukhaa Tolgod, Djadokhta Fm.	4	-6.0	1.1	-1.7	0.2	0.672	0.006	31.7	33.4	32.8	2.1	0.21	13.1	5.45	0.02	3.92
Djadokhta Spar	Spar calcite	Ukhaa Tolgod, Djadokhta Fm.	1	-6.4	0.0	-12.2	0.0	0.689	0.007		29.6	28.5	-8.9	0.11	0.0	3.22	0.01	0.32
Nodule 1	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-3.5	0.0	-11.2	0.0	0.688	0.014		29.8	28.7	-7.9	0.02	0.0	5.10	0.01	0.26
Nodule 2	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-2.2	0.0	-9.6	0.0	0.743	0.016		18.4	15.6	-8.5	2.51	30.4	8.77	0.04	0.35
Nodule 3	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-3.3	0.0	-11.7	0.0	0.720	0.011		23.1	20.9	-9.7	1.68	0.0	9.60	0.03	0.26
Nodule 4	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-3.1	0.0	-11.2	0.0	0.731	0.014		20.9	18.5	-9.7	0.18	15.7	5.22	0.06	1.01
Nodule 5	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-3.3	0.0	-11.3	0.0	0.702	0.020		26.8	25.3	-8.6	0.16	-12.5	4.94	0.04	0.32
Nodule 9	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-3.7	0.0	-11.5	0.0	0.672	0.009		33.5	32.9	-7.5	0.05	-12.7	4.13	0.00	0.23
Nodule 3	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-3.3	0.0	-11.2	0.0	0.668	0.012		34.3	33.9	-7.0	0.07	16.2	2.93	0.01	2.84
Nodule 11	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-3.9	0.0	-10.1	0.0	0.639	0.017		41.1	41.9	-4.6	0.08	10.2	2.81	0.01	2.75
Nodule 14	Carbonate nodule	Ukhaa Tolgod, Djadokhta Fm.	1	-3.4	0.0	-11.4	0.0	0.685	0.016		30.4	29.4	-8.0	2.14	0.0	10.16	0.03	0.35
Shuvuuia Bone	Bone	Ukhaa Tolgod, Djadokhta Fm.	1	-3.6	0.0	-11.7	0.0	0.668	0.010	32.8	34.3	33.9	-7.5	0.14	37.7	5.37	0.01	2.87

Highly altered samples not considered in detail:

1*	Putative titanosaurid	Coll de Nargo, Spain	4	-12.4	0.3	-0.2	0.3	0.562	0.005	64.2	61.9	66.7	9.3	1.30	16.9	5.30	0.26	3.80
2*	Putative titanosaurid	Nanxiong Basin, China	4	-9.9	0.1	-3.1	1.3	0.586	0.007	56.2	55.0	58.4	5.0	0.04	61.9	2.00	0.30	4.00
4*	Putative titanosaurid	Ningxia, Mongolia	4	-5.0	0.2	-11.3	0.1	0.678	0.001	30.3	32.1	31.3	-7.8	0.04	2.0	5.90	0.01	0.60
6	Putative titanosaurid	Rio Negro, Argentina	3	-12.7	0.1	0.4	0.2	0.651	0.003	37.2	38.2	38.5	5.2	0.16	17.7	5.74	0.37	2.29
10	Putative Troodon	Montana, USA	1	-9.5	0.0	-11.0	0.0	0.625	0.005	44.5	44.7	46.1	-5.0	0.06	93.0	5.42	0.05	1.47
11	Putative theropod	Montana, USA	1	-11.9	0.0	-8.5	0.0	0.544	0.009	70.4	67.2	73.3	1.8	0.69	35.6	3.22	0.52	1.32
13	Putative hadrosaur	Montana, USA	1	-12.1	0.0	-12.5	0.0	0.557	0.008	66.1	63.5	68.7	-2.9	0.70	0.0	13.47	1.57	0.73

*Measurements combined from different splits of the same eggshell, hence largers S.D. and S.E. may be apparent

Δ_{47} values are given on the absolute reference frame (ARF).

Supplementary Table 4. Rationale for including or excluding eggshell data from the final body temperature estimates based on preservation screening criteria.

Locality	Sample ID	Reason for including/excluding data
Ukhaa Tolgod	UT03	Included. On petrographic and EBSD inspection, specimen looked well-preserved. Bulk isotopic composition was distinct from diagenetic phases
Ukhaa Tolgod	Loose shell frag.	Included. Same justification as above
Ukhaa Tolgod	UT13	Included. Same justification as above
Ukhaa Tolgod	IGM 100/1188	Excluded as calculated water $\delta^{18}O$ approached those of diagenetic phases measured at the same site
Ukhaa Tolgod	Partial Egg	Excluded. Same justification as above
Ukhaa Tolgod	IGM 100/1062	Excluded due to evidence of alteration on petrographic inspection
Ukhaa Tolgod	IGM 100/1063	Excluded. Same justification as above
Ukhaa Tolgod	IGM 100/1066	Excluded. Same justification as above
Ukhaa Tolgod	IGM 100/1060	Excluded. Same justification as above
Bugin Tsav	IGM 100/1189	Excluded as calculated water $\delta^{18}O$ values similar to diagenetic phases and presumed meteoric water composition
Bugin Tsav	B.Tsav Egg	Excluded. Same justification as above
Bugin Tsav	BB08	Excluded. Same justification as above
Bayn Dsak	IGM 100/1150	Excluded. Same justification as above
Auca Mahuevo	AUCA L4 16	Included. This layer 4 eggshell included as petrographic and EBSD examination revealed no evidence for extensive alteration, trace element concentrations were lower than layer 2 specimens, and stable isotope ratios were distinct from sediment
Auca Mahuevo	AUCA L4 17	Included. Same justification as above
Auca Mahuevo	AUCA L4 18	Included. Same justification as above
Auca Mahuevo	7_1 (7)	Excluded. Layer 2 eggshell with trace element concentration higher than layer 4, and EBSD and petrographic examination reveals generally worse preservation than layer 4
Auca Mahuevo	7_2 (8)	Excluded. Same justification as above
Auca Mahuevo	7_3 (9)	Excluded. Same justification as above
Auca Mahuevo	12	Excluded. Same justification as above

Rousset	3*	Excluded due to EBSD analysis revealing complete recrystalization
Rousset	Rousset A1	Same justification as above
Rousset	Rousset A2	Same justification as above
Rousset	Rousset B1	Considered uncertain preservation. Stable isotope compositions very similar to soil carbonates, manganese, iron, and lithium levels higher than Rousset A and moving towards soil carbonate composition, some evidence for alteration on petrographic inspection but some also seem well preserved on EBSD
Rousset	Rousset B2	Same justification as above
Rousset	Rousset C1	Same justification as above
Rousset	Rousset C2	Same justification as above
Rousset	Rousset D1	Same justification as above
Rousset	Rousset D2	Same justification as above
Roques Hautes	FR94_031_RH.1 (ES)	Stable isotope compositions very similar to soil carbonates, manganese, iron, and lithium levels higher than Rousset A and moving towards soil carbonate composition, some evidence for alteration on petrographic inspection.
Roques Hautes	FR94_01_RH.2 (ES)	Excluded. Same justification as above
Roques Hautes	FR94_031_RH.3 (ES)	Excluded. Same justification as above

Supplementary Table 5. Modern bird and mammal data used in main text Figure 1 and Figure 6.

All data from Clarke and Rothery P. 2008. *(51)*

Class	Species	Mass (Kg)	Body Temp (°C)
Aves	*Struthio camelus*	104	39.1
Aves	*Dromaius novaehollandiae*	40.7	37.7
Aves	*Dromaius novaehollandiae*	45.4	38.3
Aves	*Apteryx australis*	2.2	36.5
Aves	*Nothura maculosa*	0.2	40.5
Aves	*Dendragapus canadensis*	0.46	42.0
Aves	*Gallus gallus*	2	41.5
Aves	*Lagopus lagopus*	0.62	41.7
Aves	*Lagopus leucurus*	0.36	41.5
Aves	*Lagopus mutus*	0.42	42.3
Aves	*Phasianus colchicus*	1.861	41.9
Aves	*Callipepla californica*	0.18	40.6
Aves	*Callipepla gambelii*	0.18	40.6
Aves	*Colinus virginianus*	0.17	41.9
Aves	*Colinus virginianus*	0.17	41.6
Aves	*Oreortyx picta*	0.22	42.1
Aves	*Oreortyx picta*	0.22	41.9
Aves	*Anas acuta*	0.85	41.9
Aves	*Anas acuta*	0.76	41.2
Aves	*Anas americana*	1.036	41.0
Aves	*Anas clypeata*	0.908	41.0
Aves	*Anas carolinensis*	0.36	41.2
Aves	*Anas cyanoptera*	0.34	41.7
Aves	*Anas discors*	0.4	42.6
Aves	*Anas laysanensis*	0.447	40.6
Aves	*Anas penelope*	0.71	41.5
Aves	*Anas platyrhynchos*	1.042	41.3
Aves	*Anas platyrhynchos*	1.17	41.2
Aves	*Anas strepera*	0.99	41.9
Aves	*Anser caerulescens*	3.065	42.1
Aves	*Aythya affinis*	0.85	41.2
Aves	*Aythya americana*	1.05	43.3
Aves	*Branta bernicla*	1.464	40.5
Aves	*Branta canadensis*	3.69	41.6
Aves	*Branta canadensis*	3.246	41.0
Aves	*Bucephala clangula*	0.71	41.5
Aves	*Cygnus buccinator*	8.88	40.1
Aves	*Lophodytes cucullatus*	0.6	42.2
Aves	*Mergus serrator*	1.317	41.9
Aves	*Mergus serrator*	1.271	41.9
Aves	*Oxyura jamaicensis*	0.62	42.2
Aves	*Spatula clypeata*	0.726	41.8
Aves	*Colaptes auratus*	0.152	42.7
Aves	*Colaptes auratus*	0.13	41.8
Aves	*Colaptes chrysoides*	0.11	42.6
Aves	*Dryocopus pileatus*	0.29	41.7
Aves	*Melanerpes carolinus*	0.063	43.0
Aves	*Melanerpes erythrocephalus*	0.09	42.6
Aves	*Melanerpes erythrocephalus*	0.09	42.2
Aves	*Melanerpes formicivorus*	0.08	42.6
Aves	*Melanerpes formicivorus*	0.08	42.3
Aves	*Melanerpes lewisi*	0.138	42.6
Aves	*Melanerpes lewisi*	0.138	41.8
Aves	*Melanerpes uropygialis*	0.066	42.6
Aves	*Melanerpes uropygialis*	0.066	41.7
Aves	*Picoides albolarvatus*	0.061	41.9
Aves	*Picoides albolarvatus*	0.061	41.7
Aves	*Picoides arcticus*	0.088	42.3
Aves	*Picoides arizonae*	0.047	42.3
Aves	*Picoides borealis*	0.044	42.5
Aves	*Picoides borealis*	0.044	42.3
Aves	*Picoides nuttalli*	0.038	42.4
Aves	*Picoides nuttalli*	0.038	42.2

Aves	*Picoides pubescens*	0.027	42.4
Aves	*Picoides pubescens*	0.027	41.8
Aves	*Picoides scalaris*	0.03	43.2
Aves	*Picoides scalaris*	0.03	41.8
Aves	*Picoides tridactylus*	0.065	42.2
Aves	*Picoides villosus*	0.066	42.6
Aves	*Picoides villosus*	0.066	42.3
Aves	*Sphyrapicus ruber*	0.0547	42.5
Aves	*Sphyrapicus ruber*	0.0547	41.7
Aves	*Sphyrapicus thyroideus*	0.0553	41.7
Aves	*Sphyrapicus thyroideus*	0.0553	41.3
Aves	*Sphyrapicus varius*	0.0622	43.0
Aves	*Sphyrapicus varius*	0.0622	42.1
Aves	*Alcedo atthis*	0.039	37.6
Aves	*Ceryle (Megaceryle) alcyon*	0.15	40.0
Aves	*Coccyzus americanus*	0.0846	42.3
Aves	*Coccyzus americanus*	0.065	40.0
Aves	*Coccyzus erythropthalmus*	0.065	43.1
Aves	*Coccyzus erythropthalmus*	0.065	42.4
Aves	*Aeronautes saxatalis*	0.0335	38.6
Aves	*Chaetura pelagica*	0.0298	41.8
Aves	*Collocalia esulenta*	0.0085	38.2
Aves	*Amazilia leucogaster*	0.0044	39.4
Aves	*Aphantochroa cirrochloris*	0.0069	44.6
Aves	*Archilochus alexandri*	0.0048	39.4
Aves	*Archilochus alexandri*	0.0033	39.3
Aves	*Archilochus colubris*	0.0041	41.1
Aves	*Archilochus colubris*	0.0048	38.6
Aves	*Calypte anna*	0.0043	41.9
Aves	*Chlorestes notatus*	0.003	38.8
Aves	*Clytolaema rubricauda*	0.0068	42.2
Aves	*Colibri serrirostris*	0.0039	42.5
Aves	*Cynanthus latirostris*	0.004	41.1
Aves	*Eupetomena macroura*	0.007	40.6
Aves	*Hylocharis cyanus*	0.003	38.8
Aves	*Lampornis clemenciae*	0.0076	37.7
Aves	*Lophornis magnificans*	0.0022	39.5
Aves	*Melanotrochilus fuscus*	0.0068	42.2
Aves	*Polytmus guainumbi*	0.0053	41.0
Aves	*Selasphorus platycercus*	0.0036	38.6
Aves	*Selasphorus rufus*	0.0045	39.0
Aves	*Thalurania furcata*	0.0041	39.6
Aves	*Tyto alba*	0.49	40.8
Aves	*Tyto alba*	0.442	38.7
Aves	*Asio flammeus*	0.368	39.0
Aves	*Asio otus*	0.288	40.1
Aves	*Bubo virginianus*	1.45	40.8
Aves	*Nyctea scandaca*	2	40.9
Aves	*Otus asio*	0.235	40.0
Aves	*Otus asio*	0.21	39.2
Aves	*Otus flammeolus*	0.063	39.2
Aves	*Athene cuncularia*	0.155	40.5
Aves	*Athene cuncularia*	0.155	40.2
Aves	*Caprimulgus europaeus*	0.085	37.6
Aves	*Caprimulgus vociferus*	0.054	42.4
Aves	*Chordeiles minor*	0.062	41.2
Aves	*Chordeiles minor*	0.062	40.9
Aves	*Chordeiles acutipennis*	0.05	42.1
Aves	*Chordeiles acutipennis*	0.05	41.9
Aves	*Phalaenoptilus nuttallii*	0.05	39.0
Aves	*Columba fasciata*	0.4875	42.2
Aves	*Columba livia*	0.386	41.0
Aves	*Columbina inca*	0.047	42.9
Aves	*Zenaida (Zeniadura) macroura*	0.123	42.5
Aves	*Zenaida asiatica*	0.15	42.7
Aves	*Grus canadensis*	3.89	40.8
Aves	*Grus paradisea*	4.03	40.6
Aves	*Aramus guarauna*	1.1	40.6
Aves	*Aramus guarauna*	1.1	40.3
Aves	*Fulica americana*	0.65	40.9
Aves	*Rallus virginianus*	0.085	40.9

Aves	*Rallus virginianus*	0.085	40.8
Aves	*Arenaria interpres*	0.11	40.2
Aves	*Calidris alba*	0.0725	39.8
Aves	*Calidris alpina*	0.06	41.6
Aves	*Calidris bairdii*	0.038	42.2
Aves	*Calidris canutus*	0.169	40.1
Aves	*Calidris ferruginea*	0.06	40.2
Aves	*Calidris himantopus*	0.058	38.0
Aves	*Calidris mauri*	0.024	41.9
Aves	*Calidris mauri*	0.024	41.8
Aves	*Calidris melanotus*	0.073	41.7
Aves	*Calidris minutilla*	0.02	41.4
Aves	*Calidris ruficollis*	0.051	40.2
Aves	*Catoptrophorus semipalmatus*	0.222	41.5
Aves	*Catoptrophorus semipalmatus*	0.222	41.4
Aves	*Gallinago gallinago*	0.105	39.1
Aves	*Limnodromus griseus*	0.103	41.2
Aves	*Limosa fedoa*	0.362	41.1
Aves	*Limosa fedoa*	0.51	40.6
Aves	*Limosa haemastica*	0.3	39.0
Aves	*Limosa lapponica*	0.455	40.9
Aves	*Limosa limosa*	0.3	39.6
Aves	*Numenius americanus*	0.597	40.9
Aves	*Numenius arquata*	0.9	39.2
Aves	*Numenius phaeopus*	0.459	39.9
Aves	*Phalaropus lobatus*	0.033	42.0
Aves	*Phalaropus lobatus*	0.035	41.4
Aves	*Phalaropus tricolor*	0.06	41.3
Aves	*Phalaropus tricolor*	0.06	40.9
Aves	*Philomachus pugnax*	0.14	40.3
Aves	*Tringa flavipes*	0.08	41.6
Aves	*Tringa flavipes*	0.08	41.2
Aves	*Tringa glareola*	0.089	41.3
Aves	*Tringa macularia*	0.06	42.4
Aves	*Tringa melanoleucus*	0.224	41.7
Aves	*Tringa melanoleucus*	0.224	41.3
Aves	*Tringa solitaria*	0.05	42.8
Aves	*Tringa totanus*	0.152	41.3
Aves	*Charadrius alexandrinus*	0.04	41.6
Aves	*Charadrius hiaticula*	0.075	39.9
Aves	*Charadrius montanus*	0.105	41.5
Aves	*Charadrius semipalmatus*	0.045	42.8
Aves	*Charadrius vociferus*	0.095	41.7
Aves	*Charadrius wilsonia*	0.06	42.2
Aves	*Himantopus mexicanus*	0.16	41.0
Aves	*Himantopus mexicanus*	0.16	41.0
Aves	*Pluvialis dominica*	0.145	38.3
Aves	*Pluvialis squatarola*	0.24	41.3
Aves	*Pluvialis squatarola*	0.24	41.2
Aves	*Recurvirostra americana*	0.315	41.4
Aves	*Recurvirostra americana*	0.315	40.5
Aves	*Vanellus vanellus*	0.2	38.2
Aves	*Aethia cristetella*	0.285	41.6
Aves	*Aethia pusilla*	0.098	41.0
Aves	*Alca torda*	0.72	41.3
Aves	*Anous stolidus*	0.2	40.3
Aves	*Cephus grylle*	0.5	40.4
Aves	*Fratercula arctica*	0.38	40.1
Aves	*Fratercula cirrhata*	0.78	39.4
Aves	*Larus glaucoides*	1.4	40.7
Aves	*Larus atricilla*	0.4	41.1
Aves	*Larus californicus*	0.965	41.5
Aves	*Larus californicus*	0.799	41.3
Aves	*Larus canus*	0.42	40.7
Aves	*Larus delawarensis*	0.52	41.3
Aves	*Larus dominicanus*	1.035	41.0
Aves	*Larus pipixcan*	0.28	41.1
Aves	*Larus pipixcan*	0.28	40.6
Aves	*Larus glaucescens*	1	41.7
Aves	*Larus hyperboreus*	1.4	42.1
Aves	*Larus philadelphia*	0.27	41.4

Aves	*Rissa tridactyla*	0.46	41.5
Aves	*Rynchops niger*	0.392	40.6
Aves	*Stercorarius (Catharacta) maccor*	1.15	41.2
Aves	*Stercorarius (Catharacta) skua*	1	41.2
Aves	*Sterna caspia*	0.782	41.7
Aves	*Sterna caspia*	0.782	40.7
Aves	*Sterna forsteri*	0.193	41.6
Aves	*Sterna forsteri*	0.193	41.3
Aves	*Sterna fuscata*	0.22	41.7
Aves	*Sterna maxima*	0.47	41.6
Aves	*Sterna maxima*	0.47	40.9
Aves	*Sterna sandvichensis*	0.238	41.6
Aves	*Synthliboramphus hypoleucus*	0.17	39.1
Aves	*Uria aalge*	0.99	41.6
Aves	*Uria lomvia*	0.97	39.0
Aves	*Accipiter striatus*	0.14	42.8
Aves	*Buteo jamaicensis*	1.08	40.6
Aves	*Buteo lagopus*	1.66	40.1
Aves	*Buteo swainsoni*	0.855	40.8
Aves	*Buteo swainsoni*	0.855	40.6
Aves	*Circus (cyaneus) hudsonius*	0.42	40.8
Aves	*Geranoaetus melanoleucus*	2.86	40.3
Aves	*Gypaetus barbatus*	5.07	40.6
Aves	*Haliaeetus leucophalus*	4.325	41.0
Aves	*Milvus migrans*	0.85	37.2
Aves	*Falco peregrinus*	0.72	40.7
Aves	*Falco sparverius*	0.1	40.5
Aves	*Aechmophorus occidentalis*	1.818	38.5
Aves	*Podiceps auritus*	0.45	40.5
Aves	*Podiceps caspicus*	0.38	40.2
Aves	*Podiceps nigricollis*	0.3	40.5
Aves	*Podilymbus podiceps*	0.551	39.3
Aves	*Sula (Morus) bassanus*	2.95	41.4
Aves	*Sula dactylatra*	2.353	40.7
Aves	*Anhinga anhinga*	1.25	40.9
Aves	*Phalacrocorax auritus*	1.7	41.3
Aves	*Phalacrocorax auritus*	1.7	41.2
Aves	*Phalacrocorax carbo*	3.63	39.8
Aves	*Phalacrocorax pelagicus*	1.8	40.5
Aves	*Ardea herodias*	1.85	40.4
Aves	*Ardea herodias*	2.4	39.8
Aves	*Botarurus lentiginosus*	1.072	40.0
Aves	*Bubulcus (Ardeola) ibis*	0.35	40.5
Aves	*Butorides virescens*	0.21	41.0
Aves	*Hydranassa tricolor*	0.38	40.8
Aves	*Nycticorax nycticorax*	1.014	39.7
Aves	*Nycticorax nycticorax*	1.014	39.2
Aves	*Phoenicopterus roseus*	3.5	41.1
Aves	*Eudocimus albus*	0.9	40.2
Aves	*Pelecanus erythrorhynchos*	13.6	39.9
Aves	*Pelecanus erythrorhynchos*	13.6	39.7
Aves	*Pelecanus occidentalis*	3.74	42.2
Aves	*Cathartes aura*	1.83	39.9
Aves	*Jabiru mycteria*	5.47	40.1
Aves	*Leptoptilus javanicus*	5.71	39.6
Aves	*Aptenodytes forsteri*	45.3	36.4
Aves	*Aptenodytes forsteri*	45.3	35.7
Aves	*Megadyptes antipodes*	8	37.8
Aves	*Pygoscelis adeliae*	5.5	38.0
Aves	*Gavia (arctica) pacifica*	1.7	39.0
Aves	*Bulweria bulwerii*	0.1	37.8
Aves	*Daption capensis*	0.45	40.6
Aves	*Diomedea exulans*	8.2	39.6
Aves	*Diomedea immutabilis*	2.1	40.6
Aves	*Diomedea nigripes*	3.1	39.2
Aves	*Macronectes giganteus*	3.9	40.6
Aves	*Pachytptila turtur*	0.47	39.9
Aves	*Pagodroma nivea*	0.322	39.6
Aves	*Procellaria aequinoctialis*	1.885	40.8
Aves	*Pterodroma hypoleuca*	0.22	38.5
Aves	*Puffinus nativitatis*	0.415	38.4

Aves	*Puffinus pacificus*	0.51	39.0
Aves	*Puffinus tenuirostris*	0.614	41.0
Aves	*Puffinus tenuirostris*	0.614	40.8
Aves	*Empidonax difficilis*	0.0118	42.3
Aves	*Empidonax flaviventris*	0.0155	42.3
Aves	*Empidonax flaviventris*	0.0155	42.2
Aves	*Empidonax hammondi*	0.0121	42.2
Aves	*Empidonax hammondi*	0.0121	41.2
Aves	*Empidonax minimus*	0.0149	42.4
Aves	*Empidonax minimus*	0.0149	41.9
Aves	*Empidonax trailli*	0.0144	42.6
Aves	*Empidonax trailli*	0.0144	42.2
Aves	*Empidonax virescens*	0.0161	42.7
Aves	*Empidonax virescens*	0.0161	42.6
Aves	*Empidonax wrighti*	0.0145	42.4
Aves	*Myiarchus cinerascens*	0.031	43.4
Aves	*Myiarchus cinerascens*	0.031	43.2
Aves	*Myiarchus tuberculifer*	0.02	43.4
Aves	*Myiarchus tuberculifer*	0.02	43.1
Aves	*Contopus pertinax*	0.027	43.5
Aves	*Contopus sordidulus*	0.013	43.6
Aves	*Contopus sordidulus*	0.013	42.7
Aves	*Contopus virens*	0.014	42.7
Aves	*Contopus cooperi*	0.032	42.8
Aves	*Contopus cooperi*	0.032	42.4
Aves	*Pyrocephalus rubinus*	0.0161	42.6
Aves	*Sayornis nigricans*	0.022	43.3
Aves	*Sayornis nigricans*	0.022	42.8
Aves	*Sayornis phoebe*	0.0244	43.3
Aves	*Tyrannus tyrannus*	0.04	42.1
Aves	*Tyrannus verticalis*	0.0441	42.5
Aves	*Tyrannus vociferans*	0.05	42.3
Aves	*Tyrannus vociferans*	0.05	41.7
Aves	*Lanius collurio*	0.0473	41.6
Aves	*Lanius excubitor*	0.069	41.5
Aves	*Lanius ludovicianus*	0.0541	42.2
Aves	*Lanius ludovicianus*	0.0541	41.9
Aves	*Vireo belli*	0.0098	41.9
Aves	*Vireo belli*	0.0098	41.3
Aves	*Vireo flavifrons*	0.018	42.2
Aves	*Vireo flavifrons*	0.018	42.1
Aves	*Vireo gilvus*	0.012	42.0
Aves	*Vireo gilvus*	0.012	41.9
Aves	*Vireo griseus*	0.0143	41.9
Aves	*Vireo huttoni*	0.0126	42.2
Aves	*Vireo olivaceus*	0.017	43.2
Aves	*Vireo olivaceus*	0.017	42.5
Aves	*Vireo philadelphia*	0.012	41.8
Aves	*Vireo solitarius*	0.016	42.2
Aves	*Vireo solitarius*	0.016	41.8
Aves	*Aphelocoma california*	0.1	42.6
Aves	*Aphelocoma california*	0.1225	41.9
Aves	*Corvus brachyrhynchos*	0.45	42.2
Aves	*Corvus corax*	1.3	42.6
Aves	*Corvus corax*	1.4	41.9
Aves	*Corvus cryptoleucus*	0.667	42.0
Aves	*Corvus cryptoleucus*	0.607	41.6
Aves	*Cyanocitta cristata*	0.109	42.9
Aves	*Cyanocitta cristata*	0.109	42.4
Aves	*Cyanocitta stelleri*	0.142	42.1
Aves	*Cyanocitta stelleri*	0.142	41.9
Aves	*Gymnorhinus cyanocephalus*	0.1	42.4
Aves	*Nucifraga caryocatactes*	0.19	42.0
Aves	*Nucifraga columbiana*	0.155	41.7
Aves	*Nucifraga columbiana*	0.161	41.4
Aves	*Perisoreus canadensis*	0.073	42.3
Aves	*Perisoreus canadensis*	0.073	41.8
Aves	*Pica nuttalli*	0.155	42.3
Aves	*Pica nuttalli*	0.155	42.1
Aves	*Pica pica*	0.209	41.8
Aves	*Pica pica*	0.197	41.7

Aves	*Bombycilla cedrorum*	0.0402	43.2
Aves	*Bombycilla cedrorum*	0.0396	42.3
Aves	*Phainopepla nitens*	0.028	41.9
Aves	*Cinclus mexicanus*	0.066	41.8
Aves	*Acrocephalus schoenobaenus*	0.0179	39.3
Aves	*Acrocephalus scirpaceus*	0.0197	39.6
Aves	*Catharus fuscescens*	0.031	42.8
Aves	*Catharus guttatus*	0.031	42.9
Aves	*Catharus guttatus*	0.031	42.0
Aves	*Catharus minimus*	0.032	43.1
Aves	*Catharus minimus*	0.032	42.4
Aves	*Catharus ustulatus*	0.031	43.6
Aves	*Catharus ustulatus*	0.031	42.4
Aves	*Chamaea fasicata*	0.0179	42.2
Aves	*Chamaea fasicata*	0.0178	41.6
Aves	*Erithacus rubecula*	0.0225	40.6
Aves	*Ficedula hypoleuca*	0.0143	40.4
Aves	*Hylocichla mustelina*	0.047	42.8
Aves	*Locustella naevia*	0.0152	42.4
Aves	*Luscinia svecica*	0.0255	41.5
Aves	*Muscicapa parva*	0.0095	40.7
Aves	*Muscicapa striata*	0.017	41.0
Aves	*Myadestes townsendi*	0.0433	42.9
Aves	*Oenanthe oenanthe*	0.029	41.2
Aves	*Phoenicurus phoenicurus*	0.019	41.0
Aves	*Phylloscopus collybita*	0.0092	41.3
Aves	*Phylloscopus sibilatrix*	0.0101	41.2
Aves	*Phylloscopus trochilus*	0.0118	40.4
Aves	*Polioptila caerulea*	0.0089	42.1
Aves	*Polioptila caerulea*	0.0089	42.0
Aves	*Polioptila plumbea*	0.007	42.1
Aves	*Regulus calendula*	0.0089	42.1
Aves	*Regulus calendula*	0.0097	42.1
Aves	*Regulus regulus*	0.0074	39.5
Aves	*Regulus satrapa*	0.0078	42.1
Aves	*Regulus satrapa*	0.0077	41.6
Aves	*Saxicola rubetra*	0.022	40.3
Aves	*Sialia currucoides*	0.029	42.2
Aves	*Sialia mexicana*	0.0325	43.1
Aves	*Sialia sialis*	0.031	42.3
Aves	*Sialia sialis*	0.031	42.2
Aves	*Sylvia atricapilla*	0.0209	40.8
Aves	*Sylvia borin*	0.0207	41.2
Aves	*Sylvia communis*	0.0246	41.2
Aves	*Sylvia curruca*	0.013	40.5
Aves	*Sylvia nisoria*	0.031	39.6
Aves	*Turdus migratorius*	0.077	43.2
Aves	*Turdus iliacus*	0.06	40.5
Aves	*Turdus philomelus*	0.08	42.8
Aves	*Dumetella carolinensis*	0.0565	42.6
Aves	*Dumetella carolinensis*	0.0565	42.6
Aves	*Mimus polyglottos*	0.0557	42.9
Aves	*Mimus polyglottos*	0.0557	42.8
Aves	*Oreoscoptes montanus*	0.0496	42.9
Aves	*Oreoscoptes montanus*	0.0463	42.8
Aves	*Sturnus vulgaris*	0.082	41.5
Aves	*Toxostoma crissale*	0.07	43.1
Aves	*Toxostoma crissale*	0.07	42.5
Aves	*Toxostoma curvirostre*	0.0905	43.2
Aves	*Toxostoma curvirostre*	0.0905	42.2
Aves	*Sitta canadensis*	0.0127	42.2
Aves	*Sitta canadensis*	0.0127	42.2
Aves	*Sitta carolinensis*	0.0267	42.1
Aves	*Sitta carolinensis*	0.0267	42.1
Aves	*Sitta pusilla*	0.01	42.1
Aves	*Sitta pusilla*	0.01	41.2
Aves	*Campylorynchus brunneicappillus*	0.039	42.5
Aves	*Catherpes mexicanus*	0.018	42.2
Aves	*Certhia familiaris*	0.0115	42.1
Aves	*Certhia familiaris*	0.0115	41.9
Aves	*Cistothorus palustris*	0.011	41.9

Aves	*Cistothorus palustris*	0.011	40.9
Aves	*Thryomanes bewicki*	0.0118	42.2
Aves	*Thryomanes bewicki*	0.0118	41.9
Aves	*Thryothorus ludovicianus*	0.022	42.7
Aves	*Thryothorus ludovicianus*	0.022	42.4
Aves	*Troglodytes aedon*	0.013	41.2
Aves	*Troglodytes troglodytes*	0.009	41.8
Aves	*Auriparus flaviceps*	0.0085	41.9
Aves	*Auriparus flaviceps*	0.0085	41.2
Aves	*Parus (Baeolophus) bicolor*	0.0215	43.0
Aves	*Parus (Baeolophus) inornatus*	0.017	42.6
Aves	*Parus (Baeolophus) wollweberi*	0.0105	42.5
Aves	*Poecile (Parus) atricapillus*	0.011	42.6
Aves	*Poecile (Parus) atricapillus*	0.011	42.2
Aves	*Poecile (Parus) caeruleus*	0.014	39.5
Aves	*Poecile (Parus) carolinensis*	0.009	42.4
Aves	*Poecile (Parus) carolinensis*	0.009	42.3
Aves	*Poecile (Parus) cinctus*	0.0125	41.5
Aves	*Poecile (Parus) gambeli*	0.011	42.8
Aves	*Poecile (Parus) gambeli*	0.011	42.4
Aves	*Poecile (Parus) palustris*	0.0105	41.6
Aves	*Poecile (Parus) sclateri*	0.011	42.1
Aves	*Poeciel (Parus) sclateri*	0.011	41.8
Aves	*Psaltriparus minimus*	0.0053	42.3
Aves	*Psaltriparus minimus*	0.0053	41.9
Aves	*Hirundo rustica*	0.019	41.4
Aves	*Progne subis*	0.056	41.9
Aves	*Progne subis*	0.056	41.6
Aves	*Riparia riparia*	0.014	41.4
Aves	*Stelgidopteryx serripennis*	0.0183	42.7
Aves	*Tachycineta (Iridiprocne) bicolor*	0.02	41.7
Aves	*Tachycineta (Iridiprocne) bicolor*	0.02	41.6
Aves	*Tachycineta thalassina*	0.0163	40.9
Aves	*Tachycineta thalassina*	0.0152	40.8
Aves	*Turdoides squamiceps*	0.07	42.0
Aves	*Alauda arvensis*	0.051	40.6
Aves	*Eremophila alpestris*	0.043	43.0
Aves	*Anthus cervinus*	0.024	40.1
Aves	*Anthus pratensis*	0.0234	40.5
Aves	*Anthus rubescens*	0.024	42.8
Aves	*Anthus rubescens*	0.024	42.2
Aves	*Anthus spinoletta*	0.024	40.3
Aves	*Anthus spraguei*	0.0292	42.6
Aves	*Anthus trivialis*	0.029	40.7
Aves	*Estrilda troglodytes*	0.0071	40.3
Aves	*Motacilla alba*	0.028	40.6
Aves	*Motacilla flava*	0.027	40.5
Aves	*Passer domesticus*	0.034	42.2
Aves	*Passer domesticus*	0.034	42.0
Aves	*Prunella modularis*	0.026	41.6
Aves	*Taeniopygia castanutis*	0.012	41.4
Aves	*Acanthis exilipes*	0.013	40.5
Aves	*Agelaius phoeniceus*	0.0811	42.4
Aves	*Agelaius phoeniceus*	0.055	42.3
Aves	*Agelaius tricolor*	0.079	42.5
Aves	*Agelaius tricolor*	0.0545	42.6
Aves	*Aimophila aestivalis*	0.0195	42.1
Aves	*Aimophila ruficeps*	0.0389	43.2
Aves	*Ammodramus henslowi*	0.013	41.2
Aves	*Ammodramus savannarum*	0.0284	42.6
Aves	*Amphispiza bilineata*	0.0164	43.3
Aves	*Amphispiza bilineata*	0.0164	42.2
Aves	*Amphispiza belli*	0.0165	43.0
Aves	*Calamospiza melanocorys*	0.0515	42.4
Aves	*Calcarius lapponicus*	0.0325	41.7
Aves	*Cardinalis cardinalis*	0.0632	42.9
Aves	*Cardinalis cardinalis*	0.0649	42.9
Aves	*Carduelis pinus*	0.015	42.4
Aves	*Carduelis pinus*	0.015	41.8
Aves	*Carduelis tristis*	0.013	42.3
Aves	*Carpodacus mexicanus*	0.0255	42.7

Aves	*Carpodacus mexicanus*	0.0255	42.2
Aves	*Carpodacus purpureus*	0.0353	42.4
Aves	*Carpodacus purpureus*	0.0353	42.4
Aves	*Compsothraupis loricata*	0.0725	42.4
Aves	*Compsothraupis loricata*	0.0725	41.8
Aves	*Dendroica auduboni*	0.016	42.1
Aves	*Dendroica caerulescens*	0.0121	42.6
Aves	*Dendroica caerulescens*	0.0124	42.2
Aves	*Dendroica castenea*	0.0136	42.7
Aves	*Dendroica castenea*	0.0151	42.2
Aves	*Dendroica cerulea*	0.0102	42.8
Aves	*Dendroica coronata*	0.0147	42.5
Aves	*Dendroica discolor*	0.0101	42.2
Aves	*Dendroica dominica*	0.01	42.4
Aves	*Dendroica fusca*	0.0098	42.1
Aves	*Dendroica fusca*	0.0098	42.3
Aves	*Dendroica graciae*	0.0091	42.2
Aves	*Dendroica magnolia*	0.0129	42.2
Aves	*Dendroica magnolia*	0.0126	42.1
Aves	*Dendroica nigrescens*	0.0088	42.3
Aves	*Dendroica palmarum*	0.0129	42.7
Aves	*Dendroica palmarum*	0.0129	42.4
Aves	*Dendroica pennsylvanica*	0.0131	42.6
Aves	*Dendroica pennsylvanica*	0.0109	42.4
Aves	*Dendroica petechia*	0.0095	42.6
Aves	*Dendroica striata*	0.0209	42.1
Aves	*Dendroica striata*	0.0209	41.9
Aves	*Dendroica tigrina*	0.0173	42.7
Aves	*Dendroica virens*	0.0113	42.2
Aves	*Dolichonyx oryzivorus*	0.0563	41.7
Aves	*Emberiza citrinella*	0.031	40.5
Aves	*Euphagus carolinus*	0.0804	43.5
Aves	*Euphagus carolinus*	0.0765	43.2
Aves	*Euphagus cyanocephalus*	0.073	42.6
Aves	*Euphagus cyanocephalus*	0.067	41.7
Aves	*Fringilla coelebs*	0.0285	40.8
Aves	*Geothlypis trichas*	0.0153	42.3
Aves	*Geothlypis trichas*	0.0121	42.2
Aves	*Helmitherus vermivorus*	0.0152	42.7
Aves	*Helmitherus vermivorus*	0.0152	41.9
Aves	*Hesperiphona vespertina*	0.0735	42.2
Aves	*Hesperiphona vespertina*	0.0861	38.1
Aves	*Icteria virens*	0.0317	42.9
Aves	*Icteria virens*	0.0338	42.2
Aves	*Icterus bullocki*	0.038	42.2
Aves	*Icterus cucullatus*	0.0332	42.9
Aves	*Icterus cucullatus*	0.0332	42.9
Aves	*Icterus galbula*	0.03975	42.8
Aves	*Icterus parisorum*	0.041	42.3
Aves	*Icterus parisorum*	0.041	42.2
Aves	*Icterus spurius*	0.02215	42.3
Aves	*Junco hyemalis*	0.0244	42.7
Aves	*Junco hyemalis*	0.0248	42.6
Aves	*Junco oreganus*	0.019	42.9
Aves	*Junco oreganus*	0.019	42.5
Aves	*Junco phaeonotus*	0.022	42.7
Aves	*Junco phaeonotus*	0.022	42.4
Aves	*Loxia curvirostra*	0.0465	42.3
Aves	*Loxia leucoptera*	0.026	43.0
Aves	*Melospiza georgiana*	0.0222	42.8
Aves	*Melospiza georgiana*	0.0222	42.7
Aves	*Melospiza lincolni*	0.024	42.1
Aves	*Melospiza melodia*	0.02	42.8
Aves	*Melospiza melodia*	0.02	42.8
Aves	*Mniotilta varia*	0.0152	42.2
Aves	*Mniotilta varia*	0.0127	42.2
Aves	*Molothrus ater*	0.0512	42.3
Aves	*Molothrus ater*	0.0508	42.3
Aves	*Oporornis formosus*	0.0206	42.1
Aves	*Oporornis philadelphia*	0.0179	42.1
Aves	*Oporornis tolmiei*	0.0126	41.7

Aves	*Oporornis tolmiei*	0.0126	42.3
Aves	*Passerculus sandwichensis*	0.02	42.9
Aves	*Passerculus sandwichensis*	0.02	42.4
Aves	*Passerella iliaca*	0.0421	42.9
Aves	*Passerella iliaca*	0.0421	42.9
Aves	*Passerina amoena*	0.0195	42.7
Aves	*Passerina amoena*	0.0169	42.3
Aves	*Passerina cyanea*	0.0186	43.2
Aves	*Passerina cyanea*	0.0214	42.0
Aves	*Peucedramus (olivaceus) taeniatu*	0.011	41.9
Aves	*Pheucticus ludovicianus*	0.045	42.7
Aves	*Pheucticus melanocephalus*	0.045	42.5
Aves	*Pinicola enucleator*	0.056	41.6
Aves	*Pipilo aberti*	0.0541	43
Aves	*Pipilo aberti*	0.051	43.6
Aves	*Pipilo crissalis*	0.0612	42.5
Aves	*Pipilo crissalis*	0.0612	42.1
Aves	*Pipilo erythrophtalmus*	0.05	43.3
Aves	*Pipilo fuscus*	0.0525	42.2
Aves	*Pipilo maculatus*	0.04	42.8
Aves	*Piranga erythromelas*	0.04	42.1
Aves	*Piranga erythromelas*	0.04	41.8
Aves	*Piranga hepatica*	0.038	42.6
Aves	*Piranga hepatica*	0.038	43.4
Aves	*Piranga ludoviciana*	0.0345	42.4
Aves	*Piranga ludoviciana*	0.0345	41.8
Aves	*Piranga rubra*	0.029	43.3
Aves	*Piranga rubra*	0.029	42.9
Aves	*Plectrophenax nivalis*	0.056	40.0
Aves	*Porphyrospiza caerulescens*	0.0314	42.2
Aves	*Quiscalus quiscula*	0.115	43.1
Aves	*Seiurus aurocapillus*	0.0288	41.9
Aves	*Seiurus motacilla*	0.0227	43.0
Aves	*Seiurus noveboracensis*	0.0244	42.8
Aves	*Seiurus noveboracensis*	0.0244	42.5
Aves	*Setophaga ruticilla*	0.012	43.9
Aves	*Setophaga ruticilla*	0.012	42.5
Aves	*Spiza americana*	0.027	42.4
Aves	*Spizella breweri*	0.0105	42.6
Aves	*Spizella breweri*	0.0105	42.4
Aves	*Spizella pallida*	0.0145	42.2
Aves	*Spizella passerina*	0.0188	43.1
Aves	*Spizella passerina*	0.0188	41.6
Aves	*Spizella pusilla*	0.0165	42.3
Aves	*Spizella pusilla*	0.0165	41.9
Aves	*Sturnella neglecta*	0.097	42.4
Aves	*Sturnella neglecta*	0.097	42.0
Aves	*Vermivora celata*	0.0116	42.1
Aves	*Vermivora celata*	0.0116	41.8
Aves	*Vermivora chrysoptera*	0.0112	43.0
Aves	*Vermivora chrysoptera*	0.0118	42.3
Aves	*Vermivora luciae*	0.0079	42.7
Aves	*Vermivora luciae*	0.0079	42.6
Aves	*Vermivora peregrina*	0.0184	42.2
Aves	*Vermivora peregrina*	0.0134	42.4
Aves	*Vermivora pinus*	0.011	41.6
Aves	*Vermivora virginiae*	0.009	42.3
Aves	*Vermivora virginiae*	0.009	42.2
Aves	*Wilsonia canadensis*	0.0126	42.0
Aves	*Wilsonia canadensis*	0.0135	41.8
Aves	*Wilsonia citrina*	0.0125	43.1
Aves	*Wilsonia pusilla*	0.0097	42.1
Aves	*Wilsonia pusilla*	0.0097	41.4
Aves	*Xanthocephalus xanthocephalus*	0.0855	42.4
Aves	*Xanthocephalus xanthocephalus*	0.056	42.3
Aves	*Zonotrichia albicollis*	0.0354	43.4
Aves	*Zonotrichia coronata*	0.026	43.1
Aves	*Zonotrichia coronata*	0.026	42.5
Aves	*Zonotrichia leucophrys*	0.029	42.8
Aves	*Zonotrichia leucophrys*	0.029	42.7
Aves	*Zonotrichia querula*	0.0363	42.7

Aves	*Zonotrichia querula*	0.0417	42.3
Mammalia	*Ornithorhynchus anatinus*	1.315	32.1
Mammalia	*Tachyglossus aculeatus*	2.725	30.7
Mammalia	*Tachyglossus setosus*	3.58	30.0
Mammalia	*Zaglossus bruijni*	10.3	30.8
Mammalia	*Notoryctes caurinus*	0.034	30.8
Mammalia	*Antechinomys laniger*	0.0258	35.8
Mammalia	*Antechinus flavipes*	0.0465	35.0
Mammalia	*Antechinus stuartii*	0.0282	35.1
Mammalia	*Antechinus swainsoni*	0.0669	36.0
Mammalia	*Dasycercus cristicaudata*	0.101	36.9
Mammalia	*Dasyuroides byrnei*	0.0917	35.2
Mammalia	*Dasyurus geoffroyi*	1.354	36.2
Mammalia	*Dasyurus hallucatus*	0.558	35.9
Mammalia	*Dasyurus maculatus*	1.782	36.9
Mammalia	*Dasyurus viverrinus*	1	36.6
Mammalia	*Myrmecobius fasciatus*	0.4	32.5
Mammalia	*Ningaui yvonnae*	0.0116	34.4
Mammalia	*Phascogale tapoatafa*	0.157	37.4
Mammalia	*Planigale gilesi*	0.0091	35.1
Mammalia	*Planigale maculata*	0.0108	34.5
Mammalia	*Planigale tenuirostris*	0.0071	34.5
Mammalia	*Pseudantechinus macdonnellensi*	0.0431	34.2
Mammalia	*Sarcophilus (harrisi) laniarus*	7.6	34.9
Mammalia	*Sarcophilus harrisii*	5.775	35.8
Mammalia	*Sminthopsis (laripinta) macroura*	0.011	36.4
Mammalia	*Sminthopsis crassicaudata*	0.0164	35.2
Mammalia	*Sminthopsis macroura*	0.01935	33.3
Mammalia	*Sminthopsis murina*	0.019	35.0
Mammalia	*Isoodon auratus*	0.428	33.8
Mammalia	*Isoodon macrourus*	1.551	35.9
Mammalia	*Isoodon obesulus*	0.717	33.9
Mammalia	*Macrotis lagotis*	1.294	35.0
Mammalia	*Perameles gunni*	0.837	35.2
Mammalia	*Perameles nasuta*	0.645	36.1
Mammalia	*Echymipera kalabu*	0.695	35.0
Mammalia	*Echymipera (rufescens) australis*	0.616	34.6
Mammalia	*Echymipera (rufescens) rufescens*	1.276	35.2
Mammalia	*Tarsipes rostratus*	0.01	36.6
Mammalia	*Lasiorhinus latifrons*	29.917	35.3
Mammalia	*Spilocuscus maculatus*	4.25	34.7
Mammalia	*Trichosurus caninus*	3.19	37.0
Mammalia	*Trichosurus fuliginosus (vulpeca)*	5.06	36.2
Mammalia	*Trichosurus vulpecula*	2.005	36.0
Mammalia	*Burramys parvus*	0.0443	36.1
Mammalia	*Cercartetus concinnus*	0.0186	34.4
Mammalia	*Cercartetus lepidus*	0.0126	33.7
Mammalia	*Cercartetus nanus*	0.07	35.6
Mammalia	*Aepyprimnus rufescens*	2.82	36.5
Mammalia	*Bettongia gaimardi*	1.385	35.6
Mammalia	*Bettongia penicillata*	1.018	37.2
Mammalia	*Dendrolagus matschiei*	6.96	36.3
Mammalia	*Lagorchestes conspicillatus*	2.66	36.0
Mammalia	*Macropus (major) fuliginosus*	30.7	37.2
Mammalia	*Macropus (Wallabia) agilis*	18.74	37.9
Mammalia	*Macropus (Wallabia) dorsalis*	2.79	37.4
Mammalia	*Macropus eugenii*	4.878	36.5
Mammalia	*Macropus giganteus*	45	36.0
Mammalia	*Macropus parryi (Wallabia elegan*	8.75	36.7
Mammalia	*Macropus robustus*	29.3	36.1
Mammalia	*Megaleia (Macropus) rufa*	32.49	35.9
Mammalia	*Potorous tridactylus*	0.976	35.9
Mammalia	*Setonyx brachyurus*	2.674	36.3
Mammalia	*Wallabia bicolor*	7	39.9
Mammalia	*Wallabia rufogriseus*	9.7	37.7
Mammalia	*Petauroides volans*	1.141	35.4
Mammalia	*Petaurus breviceps*	0.128	36.4
Mammalia	*Petaurus norfolcensis*	0.236	36.3
Mammalia	*Pseudocheirus occidentalis*	0.861	36.5
Mammalia	*Pseudocheirus peregrinus*	0.916	37.4

Mammalia	*Phascolarctos cinereus*	4.765	35.8
Mammalia	*Acrobates pygmaeus*	0.014	34.7
Mammalia	*Caluromys derbianus*	0.329	35.0
Mammalia	*Chironectes (panamensis)*	0.946	34.6
Mammalia	*Chironectes minimus*	0.935	35.0
Mammalia	*Didelphis marsupialis*	1.165	35.0
Mammalia	*Didelphis virginiana*	2.488	35.0
Mammalia	*Gracilinanus microtarsus*	0.013	35.0
Mammalia	*Lutreolina crassicaudata*	0.812	35.8
Mammalia	*Marmosa robinsoni*	0.122	34.0
Mammalia	*Metachirus nudicaudatus*	0.336	35.0
Mammalia	*Monodelphis brevicaudata*	0.0755	33.7
Mammalia	*Monodelphis domestica*	0.104	32.6
Mammalia	*Philander opossum*	0.751	35.8
Mammalia	*Caenolestes (obscurus) fuliginosu*	0.04	35.4
Mammalia	*Cabassous centralis*	4.33	33.6
Mammalia	*Chaetophractus nationi*	2.15	35.5
Mammalia	*Chaetophractus vellerosus*	1.11	34.4
Mammalia	*Chaetophractus villosus*	4.54	35.1
Mammalia	*Dasypus novemcinctus*	3.51	34.5
Mammalia	*Euphractus sexcinctus*	8.19	34.2
Mammalia	*Priodontes maximus*	45.19	33.6
Mammalia	*Tolypeutes matacus*	1.16	33.0
Mammalia	*Zaedyus pichi*	1.74	35.2
Mammalia	*Cyclopes didactylus*	0.24	33.0
Mammalia	*Myrmecophaga tridactyla*	30.6	32.5
Mammalia	*Tamandua mexicana*	3.977	32.0
Mammalia	*Tamandua tetradactyla*	3.5	33.5
Mammalia	*Choloepus hoffmanni*	3.77	34.4
Mammalia	*Bradypus tridactylus*	2.35	31.5
Mammalia	*Bradypus variegatus*	3.79	33.0
Mammalia	*Elephantulus brachyrhynchus*	0.0453	37.5
Mammalia	*Elephantulus edwardii*	0.05	37.6
Mammalia	*Elephantulus intufi*	0.04649	37.2
Mammalia	*Elephantulus myurus*	0.06297	36.9
Mammalia	*Elephantulus rozeti*	0.04531	37.1
Mammalia	*Elephantulus rufescens*	0.053	37.3
Mammalia	*Macroscelides proboscideus*	0.039	36.2
Mammalia	*Petrodromus tetradactylus*	0.20611	37.5
Mammalia	*Ochotona collaris*	0.06	39.0
Mammalia	*Ochotona princeps*	0.109	40.1
Mammalia	*Lepus alleni*	3	37.9
Mammalia	*Lepus americanus*	1.581	39.8
Mammalia	*Lepus arcticus*	3.0044	38.9
Mammalia	*Lepus californicus*	2.3	39.2
Mammalia	*Lepus timidus*	3.025	39.7
Mammalia	*Lepus townsendii*	2.43	38.2
Mammalia	*Oryctolagus cuniculus*	2	39.0
Mammalia	*Sylvilagus audubonii*	0.6724	38.3
Mammalia	*Sylvilagus floridanus*	0.8	39.4
Mammalia	*Aplodontia rufa*	0.63	38.0
Mammalia	*Ammospermophilus leucurus*	0.0957	37.5
Mammalia	*Cynomys (Citellus) leucurus*	0.079	37.2
Mammalia	*Cynomys ludovicanus*	1.1123	36.7
Mammalia	*Funisciurus congicus*	0.1123	39.3
Mammalia	*Glaucomys volans*	0.06425	39.0
Mammalia	*Marmota caligata*	1	38.3
Mammalia	*Marmota flaviventris*	4.295	36.5
Mammalia	*Marmota monax*	2.65	37.0
Mammalia	*Paraxerus cepapi*	0.2236	39.1
Mammalia	*Paraxerus (palliatus) ornatus*	0.3666	39.3
Mammalia	*Paraxerus (palliatus) tongensis*	0.206	38.8
Mammalia	*Sciurus aberti*	0.624	40.7
Mammalia	*Sciurus carolinensis*	0.44	38.7
Mammalia	*Spermophilus (Citellus) franklinii*	0.607	36.6
Mammalia	*Spermophilus armatus*	0.32	35.7
Mammalia	*Spermophilus beecheyi*	0.5996	37.6
Mammalia	*Spermophilus beldingi*	0.303	35.5
Mammalia	*Spermophilus citellus*	0.24	37.5
Mammalia	*Spermophilus lateralis*	0.237	36.3
Mammalia	*Spermophilus mohavensis*	0.24	37.0

Mammalia	*Spermophilus parryi*	0.65	37.0
Mammalia	*Spermophilus richardsoni*	0.274	35.5
Mammalia	*Spermophilus spilosoma*	0.174	36.1
Mammalia	*Spermophilus tereticaudus*	0.167	36.3
Mammalia	*Spermophilus townsendii*	0.229	35.6
Mammalia	*Spermophilus tridecemlineatus*	0.2054	35.7
Mammalia	*Spermophilus undulatus*	0.68	38.0
Mammalia	*Tamias amoenus*	0.0571	37.0
Mammalia	*Tamias merriami*	0.075	37.0
Mammalia	*Tamias minimus*	0.0458	37.0
Mammalia	*Tamias striatus*	0.0874	38.2
Mammalia	*Tamiasciurus hudsonicus*	0.2283	38.7
Mammalia	*Tamiasciurus preblei*	0.18	39.4
Mammalia	*Xerus inauris*	0.542	36.8
Mammalia	*Xerus princeps*	0.602	37.6
Mammalia	*Dipus sagitta*	0.16	36.8
Mammalia	*Jaculus jaculus*	0.075	37.5
Mammalia	*Jaculus orientalis*	0.139	37.0
Mammalia	*Napaeozapus insignis*	0.022	37.0
Mammalia	*Sicista betulina*	0.012	37.0
Mammalia	*Zapus hudsonicus*	0.0238	37.3
Mammalia	*Zapus princeps*	0.026	36.6
Mammalia	*Abrothrix longipilis*	0.0423	37.4
Mammalia	*Acomys cahirinus*	0.042	37.5
Mammalia	*Acomys russatus*	0.05555	37.3
Mammalia	*Aethomys namaquensis*	0.0642	36.8
Mammalia	*Akodon azarae*	0.024	37.7
Mammalia	*Apodemus flavicollis*	0.0239	36.7
Mammalia	*Apodemus hermonensis*	0.0205	37.0
Mammalia	*Apodemus mystacinus*	0.0404	35.5
Mammalia	*Apodemus sylvaticus*	0.0239	36.7
Mammalia	*Arborimus longicaudus*	0.0218	37.3
Mammalia	*Arvicola terrestris*	0.092	37.5
Mammalia	*Auliscomys micropus*	0.0623	37.4
Mammalia	*Baiomys taylori*	0.00715	36.0
Mammalia	*Calomys musculinus*	0.0169	36.2
Mammalia	*Calomys venustus*	0.0501	37.1
Mammalia	*Cannomys badius*	0.344	36.0
Mammalia	*Chelemys macronyx*	0.062	36.8
Mammalia	*Chroeomys anadinus*	0.0346	37.7
Mammalia	*Chroeomys olivaceus*	0.027	37.2
Mammalia	*Clethrionomys californicus*	0.0183	37.5
Mammalia	*Clethrionomys gapperi*	0.0223	37.9
Mammalia	*Cricetomys gambianus*	1.87	35.6
Mammalia	*Cricetulus migratorius*	0.0307	38.1
Mammalia	*Cricetus cricetus*	0.362	39.5
Mammalia	*Desmodillus auricularis*	0.07193	35.9
Mammalia	*Dicrostonyx groenlandicus*	0.05962	38.4
Mammalia	*Eligmodontia typus*	0.0175	36.4
Mammalia	*Gerbillurus paeba*	0.0339	38.7
Mammalia	*Gerbillurus setzeri*	0.0461	37.6
Mammalia	*Gerbillurus tytonis*	0.0299	36.9
Mammalia	*Gerbillurus vallinus*	0.0388	37.4
Mammalia	*Gerbillus allenybi*	0.0353	36.3
Mammalia	*Gerbillus dasyurus*	0.0276	38.6
Mammalia	*Gerbillus gerbillus*	0.0297	37.2
Mammalia	*Gerbillus nanus*	0.0284	38.8
Mammalia	*Gerbillus pusillus*	0.0126	34.6
Mammalia	*Gerbillus pyramidum*	0.1085	36.1
Mammalia	*Graomys griseoflavus*	0.0694	36.1
Mammalia	*Hydromys chrysogaster*	0.9	36.6
Mammalia	*Isthmomys pirrensis*	0.1379	37.6
Mammalia	*Lagurus curtatus*	0.0303	37.1
Mammalia	*Lemmus lemmus*	0.08	37.8
Mammalia	*Lemmus sibericus*	0.0502	38.3
Mammalia	*Lemniscomys griselda*	0.0475	36.9
Mammalia	*Lemniscomys rosalia*	0.05053	36.5
Mammalia	*Malacothrix typica*	0.0217	37.0
Mammalia	*Maresomys boliviensis*	0.0768	36.3
Mammalia	*Mastomys natalensis*	0.0415	38.0
Mammalia	*Megadontomys thomasi*	0.1108	37.8

Mammalia	*Melomys lutillus*	0.038	37.5
Mammalia	*Meriones hurriane*	0.069	36.1
Mammalia	*Meriones tristrami*	0.112	36.5
Mammalia	*Meriones unguiculatus*	0.067	38.2
Mammalia	*Mesocricetus auratus*	0.098	38.1
Mammalia	*Micromys minutus*	0.00737	38.0
Mammalia	*Microtus agrestis*	0.028	37.6
Mammalia	*Microtus arvalis*	0.02	37.0
Mammalia	*Microtus brandti*	0.0402	36.2
Mammalia	*Microtus breweri*	0.0531	37.3
Mammalia	*Microtus californicus*	0.044	38.8
Mammalia	*Microtus guentheri*	0.0438	38.3
Mammalia	*Microtus longicaudus*	0.0286	38.0
Mammalia	*Microtus mexicanus*	0.0288	37.9
Mammalia	*Microtus montanus*	0.0351	35.3
Mammalia	*Microtus ochrogaster*	0.0467	37.9
Mammalia	*Microtus oeconomus*	0.0337	38.4
Mammalia	*Microtus pennsylvanicus*	0.0389	38.5
Mammalia	*Microtus pinetorum*	0.0255	38.3
Mammalia	*Microtus richardsoni*	0.06565	38.7
Mammalia	*Microtus xanthognathus*	0.0685	38.0
Mammalia	*Mus minutoides*	0.00806	36.3
Mammalia	*Mus musculus*	0.046	36.7
Mammalia	*Myopus schisticolor*	0.0264	39.0
Mammalia	*Mystromys albicaudatus*	0.09378	33.0
Mammalia	*Nannospalax ehrenbergi*	0.135	36.0
Mammalia	*Nannospalax leucodon*	0.201	36.3
Mammalia	*Neofiber alleni*	0.2581	37.1
Mammalia	*Neotoma fuscipes*	0.187	36.6
Mammalia	*Neotoma lepida*	0.11	36.8
Mammalia	*Notomys alexis*	0.0323	38.0
Mammalia	*Notomys cervinus*	0.0342	38.5
Mammalia	*Ochrotomys nuttalli*	0.0195	36.4
Mammalia	*Oligoryzomys longicaudatus*	0.0282	37.3
Mammalia	*Ondatra zibethicus*	1.0046	37.4
Mammalia	*Otomys irroratus*	0.102	37.6
Mammalia	*Otomys sloggetti*	0.11329	38.0
Mammalia	*Otomys unisulcatus*	0.096	34.8
Mammalia	*Oxymycterus roberti*	0.0835	38.3
Mammalia	*Parotomys brantsii*	0.0865	35.1
Mammalia	*Peromyscus c. insignis*	0.0455	36.0
Mammalia	*Peromyscus c. parasiticus*	0.0496	36.4
Mammalia	*Peromyscus californicus*	0.0476	36.4
Mammalia	*Peromyscus crinitus*	0.0159	35.7
Mammalia	*Peromyscus eremicus*	0.0215	36.6
Mammalia	*Peromyscus gossypinus*	0.0215	37.5
Mammalia	*Peromyscus l. noveboracensis*	0.026	37.5
Mammalia	*Peromyscus leucopus*	0.02	36.7
Mammalia	*Peromyscus maniculatus*	0.0228	36.6
Mammalia	*Peromyscus m. austerus*	0.01953	36.3
Mammalia	*Peromyscus m. gambeli*	0.0191	36.8
Mammalia	*Peromyscus m. nebrascensis*	0.01893	35.9
Mammalia	*Peromyscus m. sonoriensis*	0.02038	36.7
Mammalia	*Peromyscus m.artemisidae*	0.02319	37.2
Mammalia	*Peromyscus oreas*	0.02458	36.2
Mammalia	*Peromyscus polionotus*	0.014	37.2
Mammalia	*Peromyscus sitkensis*	0.0283	36.0
Mammalia	*Peromyscus truei gilberti*	0.0333	36.4
Mammalia	*Peromyscus truei truei*	0.0332	36.7
Mammalia	*Phenacomys intermedius*	0.0215	37.9
Mammalia	*Phodopus sungorus*	0.0257	36.1
Mammalia	*Phyllotis (darwini) darwini*	0.059	36.2
Mammalia	*Phyllotis (darwini) rupestris*	0.036	37.1
Mammalia	*Phyllotis xanthopygus*	0.055	37.3
Mammalia	*Pseudomys gracilicaudatus*	0.0798	36.8
Mammalia	*Pseudomys hermannsburgensis*	0.0122	37.8
Mammalia	*Rattus (conatus) sordidus*	0.09	39.0
Mammalia	*Rattus fuscipes*	0.076	37.5
Mammalia	*Rattus lutreolis*	0.109	36.7
Mammalia	*Rattus norvegicus*	0.349	37.2
Mammalia	*Rattus villosissimus*	0.2506	35.9

Mammalia	*Reithrodon auritus*	0.009	38.0
Mammalia	*Reithrodontomys megalotis*	0.009	36.8
Mammalia	*Rhabdomys pumilio*	0.0396	37.0
Mammalia	*Saccostomus campestris*	0.0613	35.3
Mammalia	*Scotinomys teguina*	0.012	37.6
Mammalia	*Scotinomys xerampelinus*	0.0152	36.2
Mammalia	*Sekeetamys calurus*	0.0569	37.5
Mammalia	*Sigmodon hispidus*	0.1393	38.1
Mammalia	*Solomys (Uromys) (sherrini)*	0.508	37.1
Mammalia	*Steatomys pratensis*	0.03754	34.1
Mammalia	*Tachyoryctes splendens*	0.191	35.9
Mammalia	*Tatera afra*	0.1065	34.0
Mammalia	*Tatera leucogaster*	0.15762	35.1
Mammalia	*Thallomys paedulcus*	0.1324	36.7
Mammalia	*Eliomys quercinus*	0.062	38.2
Mammalia	*Glis (Myoxus) glis*	0.2	37.7
Mammalia	*Muscardenis avellanarius*	0.0235	35.8
Mammalia	*Chaetodipus baileyi*	0.0291	32.5
Mammalia	*Chaetodipus californicus*	0.022	38.0
Mammalia	*Chaetodipus fallax*	0.0196	32.6
Mammalia	*Chaetodipus hispidus*	0.0395	36.8
Mammalia	*Chaetodipus intermedius*	0.015	36.0
Mammalia	*Dipodomys agilis*	0.0606	37.0
Mammalia	*Dipodomys deserti*	0.106	36.8
Mammalia	*Dipodomys merriami*	0.0365	37.0
Mammalia	*Dipodomys microps*	0.0572	35.0
Mammalia	*Dipodomys ordii*	0.0468	34.6
Mammalia	*Dipodomys panamintinus*	0.0642	36.9
Mammalia	*Dipodomys spectabilis*	0.125	37.4
Mammalia	*Geomys bursaris*	0.197	35.0
Mammalia	*Geomys pinetis*	0.173	36.3
Mammalia	*Heteromys anomalus*	0.0693	36.0
Mammalia	*Heteromys desmarestianus*	0.0758	33.8
Mammalia	*Liomys irroratus*	0.0481	37.0
Mammalia	*Liomys salvani*	0.0438	37.0
Mammalia	*Microdipodops megacephalus*	0.011	32.8
Mammalia	*Microdipodops pallidus*	0.0152	39.3
Mammalia	*Perognathus alticola*	0.018	34.7
Mammalia	*Perognathus californicus*	0.022	37.3
Mammalia	*Perognathus flavus*	0.0083	34.6
Mammalia	*Perognathus longimembris*	0.0089	34.7
Mammalia	*Thomomys bottae*	0.143	36.0
Mammalia	*Thomomys talpoides*	0.1068	36.2
Mammalia	*Thomomys umbrinus*	0.085	34.6
Mammalia	*Pedetes capensis*	2.3	35.9
Mammalia	*Hystrix africaeaustralis*	11.3	37.5
Mammalia	*Coendou prehensilis*	3.28	36.7
Mammalia	*Erethizon dorsatum*	10.5	37.5
Mammalia	*Bathyergus janetta*	0.406	34.7
Mammalia	*Bathyergus suillus*	0.62	35.3
Mammalia	*Cryptomys bocagei*	0.094	33.7
Mammalia	*Cryptomys damarensis*	0.138	35.2
Mammalia	*Cryptomys darlingi*	0.06	33.3
Mammalia	*Cryptomys hottentotus*	0.075	34.4
Mammalia	*Cryptomys (hottentotus) amatus*	0.0795	35.0
Mammalia	*Cryptomys mechowi*	0.267	34.0
Mammalia	*Georychus capensis*	0.195	36.4
Mammalia	*Heliophobius argentocinereus*	0.088	35.1
Mammalia	*Heterocephalus glaber*	0.032	32.1
Mammalia	*Agouti paca*	9.156	37.2
Mammalia	*Dasyprocta acouchy*	0.6	38.8
Mammalia	*Dasyprocta azarae*	3.849	37.5
Mammalia	*Dasyprocta leporina*	2.687	38.3
Mammalia	*Dasyprocta prymnolopha*	2.9	38.8
Mammalia	*Myoprocta acouchy*	0.914	35.4
Mammalia	*Cavia porcellus*	0.629	39.0
Mammalia	*Dolichotis salinicola*	1.613	38.4
Mammalia	*Galea musteloides*	0.322	37.3
Mammalia	*Kerodon ruprestris*	0.801	38.2
Mammalia	*Hydrochaeris hydrochaeris*	26.385	37.1
Mammalia	*Aconaemys fuscus*	0.112	37.3

Mammalia	*Ctenomys australis*	0.34	37.3
Mammalia	*Ctenomys fulvus*	0.3	36.2
Mammalia	*Ctenomys maulinus*	0.215	36.2
Mammalia	*Ctenomys opimus*	0.214	36.0
Mammalia	*Ctenomys peruanus*	0.49	35.2
Mammalia	*Ctenomys talarum*	0.121	36.1
Mammalia	*Octodon degus*	0.193	37.6
Mammalia	*Octodontomys gliroides*	0.152	37.2
Mammalia	*Octomys mimax*	0.1186	36.7
Mammalia	*Spalacopus cyanus*	0.135	36.5
Mammalia	*Tympanoctomys barrerae*	0.0714	35.7
Mammalia	*Myocastor (Myopotamus) coypus*	7.29	38.0
Mammalia	*Proechimys semispinosus*	0.498	37.9
Mammalia	*Thrichomys apereoides*	0.323	37.6
Mammalia	*Capromys pilorides*	2.63	36.1
Mammalia	*Chinchilla laniger*	0.426	35.7
Mammalia	*Lagostomus maximus*	6.784	36.8
Mammalia	*Manis crassicaudata*	15.91	33.4
Mammalia	*Manis javanica*	4.22	32.3
Mammalia	*Manis pentadactyla*	3.6375	33.4
Mammalia	*Manis tetradactyla*	1.43	33.0
Mammalia	*Manis tricuspis*	1.365	32.6
Mammalia	*Arctictis binturong*	14.28	36.7
Mammalia	*Arctogalidia trivirgata*	2.01	36.2
Mammalia	*Fossa fossana*	2.26	37.9
Mammalia	*Nandinia binotata*	4.27	37.4
Mammalia	*Paradoxurus hermaphroditus*	3.16	36.5
Mammalia	*Viverra megaspila*	10	38.1
Mammalia	*Viverricula indica*	3	38.9
Mammalia	*Acinonyx jubatus*	37.9	39.0
Mammalia	*Felis concolor*	37.2	37.6
Mammalia	*Felis pardalis*	10.5	38.0
Mammalia	*Felis serval*	10.1	36.5
Mammalia	*Felis wiedii*	3.6	38.0
Mammalia	*Felis yagouaroundi*	8.4	38.4
Mammalia	*Panthera leo*	98	37.9
Mammalia	*Panthera tigris*	137.9	37.5
Mammalia	*Galerella sanguinea*	0.54	38.7
Mammalia	*Herpestes javanicus*	0.611	39.8
Mammalia	*Herpestes sanguineus*	0.54	38.7
Mammalia	*Ichneumia albicauda*	2.1	39.4
Mammalia	*Suricata suricatta*	0.85	36.3
Mammalia	*Proteles cristatus*	8.1	36.4
Mammalia	*Alopex lagopus*	3.6	38.6
Mammalia	*Canis latrans*	10	37.0
Mammalia	*Canis lupus (familiaris)*	40	38.4
Mammalia	*Canis mesomelas*	7.72	38.0
Mammalia	*Cerdocyon thous*	5.444	38.2
Mammalia	*Fennecus zerda*	1.215	38.8
Mammalia	*Vulpes macrotis*	1.769	38.0
Mammalia	*Vulpes vulpes*	4.44	38.7
Mammalia	*Ursus americanus*	70	38.3
Mammalia	*Ursus arctos*	11.45	38.0
Mammalia	*Ursus maritimus*	142	36.8
Mammalia	*Eumetopias jubata*	1000	38.5
Mammalia	*Erignathus barbatus*	24.75	37.2
Mammalia	*Mirounga angustirostris*	363	35.0
Mammalia	*Odobenus rosmarus*	10600	36.4
Mammalia	*Eira barbara*	2.95	38.4
Mammalia	*Enhydra lutris*	15	38.5
Mammalia	*Galictis (barbara) cuja*	4.286	40.1
Mammalia	*Galictis vittata*	3.2	38.3
Mammalia	*Lutra lutra*	10	38.1
Mammalia	*Martes americana*	0.9	38.0
Mammalia	*Mustela erminea*	0.075	39.6
Mammalia	*Mustela frenata*	0.225	39.0
Mammalia	*Mustela furo*	0.833	39.0
Mammalia	*Mustela putorius*	0.135	39.5
Mammalia	*Mustela rixosa*	0.075	40.4
Mammalia	*Mustela vison*	0.66	39.0
Mammalia	*Spilogale putorius*	0.624	36.4

Mammalia	*Taxidea taxus*	9	38.0
Mammalia	*Ailurus fulgens*	5.74	37.6
Mammalia	*Bassaris astutus*	1.13	37.6
Mammalia	*Bassariscus sumichrasti*	1.28	38.8
Mammalia	*Nasua narica*	3.67	38.6
Mammalia	*Nasua nasua*	4	36.4
Mammalia	*Potos flavus*	2.343	36.1
Mammalia	*Procyon cancrivorus*	7.48	37.6
Mammalia	*Procyon lotor*	5.075	38.0
Mammalia	*Chrysochloris asiatica*	0.044	34.0
Mammalia	*Eremitalpa granti namibensis*	0.02	33.6
Mammalia	*Atelerix albiventris*	0.45	35.2
Mammalia	*Echinosorex gymnura*	0.7212	36.3
Mammalia	*Erinaceus concolor*	0.8227	35.2
Mammalia	*Erinaceus europaeus*	0.785	35.6
Mammalia	*Hemiechinus auritus*	0.4	33.8
Mammalia	*Hylomys suillus*	0.0578	37.3
Mammalia	*Paraechinus aethiopicus*	0.45	34.2
Mammalia	*Condylura cristata*	0.049	37.7
Mammalia	*Neurotrichus gibbsii*	0.0118	38.4
Mammalia	*Scalopus aquaticus*	0.048	36.0
Mammalia	*Blarina brevicaudata*	0.0205	38.3
Mammalia	*Blarina carolinensis*	0.0102	36.8
Mammalia	*Crocidura crossei*	0.0102	34.3
Mammalia	*Crocidura hildegardeae*	0.01	35.7
Mammalia	*Crocidura luna*	0.0118	34.8
Mammalia	*Crocidura olivieri*	0.0389	35.3
Mammalia	*Crocidura poensis*	0.0173	35.5
Mammalia	*Crocidura russula*	0.0104	34.7
Mammalia	*Crocidura suaveolens*	0.0065	35.1
Mammalia	*Crocidura viaria*	0.0147	34.5
Mammalia	*Cryptotis parva*	0.0062	37.0
Mammalia	*Neomys fodiens*	0.0171	37.3
Mammalia	*Notiosorex crawfordi*	0.004	37.6
Mammalia	*Sorex alpinus*	0.0079	38.6
Mammalia	*Sorex cinereus*	0.0035	38.4
Mammalia	*Sorex coronatus*	0.0091	37.6
Mammalia	*Sorex minutus*	0.004	38.5
Mammalia	*Sorex palustris*	0.012	39.7
Mammalia	*Sorex vagrans*	0.0052	38.0
Mammalia	*Suncus etruscus*	0.0024	36.0
Mammalia	*Suncus murinus*	0.0302	38.7
Mammalia	*Geogale aurita*	0.007	34.9
Mammalia	*Microgale cowani*	0.0122	33.0
Mammalia	*Microgale dobsoni*	0.0446	30.9
Mammalia	*Microgale melanorrhachis*	0.012	33.9
Mammalia	*Microgale talazaci*	0.044	31.2
Mammalia	*Setifer setosus*	0.53	32.2
Mammalia	*Tenrec ecaudatus*	0.65	33.0
Mammalia	*Cynopterus brachyotis*	0.0374	36.5
Mammalia	*Dobsonia anderseni*	0.2414	36.4
Mammalia	*Dobsonia minor*	0.0737	36.5
Mammalia	*Dobsonia moluccensis*	0.4043	36.8
Mammalia	*Dobsonia praedatrix*	0.1795	37.1
Mammalia	*Eonycteris spelaea*	0.0516	34.0
Mammalia	*Macroglossus minimus*	0.0159	36.2
Mammalia	*Melonycteris melanops*	0.0533	34.9
Mammalia	*Nyctimene albiventer*	0.0309	35.9
Mammalia	*Nyctimene cyclotis*	0.0404	36.0
Mammalia	*Nyctimene major*	0.0136	33.0
Mammalia	*Paranyctimene raptor*	0.0236	33.8
Mammalia	*Pteropus giganteus*	0.5622	36.7
Mammalia	*Pteropus hypomelanus*	0.5208	35.7
Mammalia	*Pteropus poliocephalus*	0.598	36.5
Mammalia	*Pteropus pumilus*	0.1942	36.1
Mammalia	*Pteropus rodricensis*	0.2545	36.5
Mammalia	*Pteropus scapulatus*	0.362	37.0
Mammalia	*Pteropus vampyrus*	1.0243	36.9
Mammalia	*Rousettus aegyptiacus*	0.146	34.8
Mammalia	*Rousettus amplexicaudatus*	0.0915	36.5
Mammalia	*Syconycteris australis*	0.0159	35.9

Mammalia	*Peropteryx macrotis*	0.005	34.4
Mammalia	*Saccopteryx bilineata*	0.0078	35.5
Mammalia	*Macroderma gigas*	0.148	37.0
Mammalia	*Hipposideros galeritus*	0.0085	31.9
Mammalia	*Rhinolophus ferrumequinum*	0.014	39.7
Mammalia	*Rhinolophus hipposideros*	0.004	30.2
Mammalia	*Rhinonycteris aurantius*	0.00827	36.1
Mammalia	*Noctilio albiventris*	0.027	32.0
Mammalia	*Noctilio leporinus*	0.061	33.8
Mammalia	*Noctillo albiventris*	0.04	34.5
Mammalia	*Mormoops blainvilli*	0.0086	32.0
Mammalia	*Mormoops megalophylla*	0.0165	36.9
Mammalia	*Pteronotus davyi*	0.0094	38.8
Mammalia	*Pteronotus parnellii*	0.0192	36.4
Mammalia	*Pteronotus personatus*	0.014	37.5
Mammalia	*Pteronotus quadridens*	0.0049	31.0
Mammalia	*Anoura caudifera*	0.0115	36.5
Mammalia	*Artibeus jamaicensis*	0.0452	36.4
Mammalia	*Artibeus lituratus*	0.0701	37.3
Mammalia	*Carollia perspicillata*	0.0149	36.4
Mammalia	*Chrotopterus auritus*	0.0961	37.2
Mammalia	*Desmodus rotundus*	0.03	37.3
Mammalia	*Diaemus youngi*	0.0366	31.1
Mammalia	*Diphylla ecaudata*	0.0278	32.4
Mammalia	*Erophylla bombifrons*	0.0161	32.0
Mammalia	*Glossophaga soricina*	0.0096	35.5
Mammalia	*Koopmania concolor*	0.0197	35.3
Mammalia	*Leptonycteris curasoae*	0.022	35.7
Mammalia	*Macrotus californicus*	0.0117	35.0
Mammalia	*Monophyllus redmani*	0.0087	34.0
Mammalia	*Phyllostomus discolor*	0.0335	34.6
Mammalia	*Phyllostomus hastatus*	0.0842	34.7
Mammalia	*Platyrrhinus lineatus*	0.0219	36.4
Mammalia	*Rhinophylla pumilio*	0.0095	34.7
Mammalia	*Sturnira lilium*	0.0219	36.4
Mammalia	*Tonatia bidens*	0.0274	37.0
Mammalia	*Uroderma bilobatum*	0.0162	35.1
Mammalia	*Natalus tumidirostris*	0.0054	32.2
Mammalia	*Eumops perotis*	0.056	32.6
Mammalia	*Molossus molossus*	0.0156	31.4
Mammalia	*Tadarida brasiliensis*	0.0169	36.0
Mammalia	*Chalinolobus gouldii*	0.018	35.5
Mammalia	*Eptesicus fuscus*	0.0104	36.0
Mammalia	*Histiotus velatus*	0.0112	30.5
Mammalia	*Miniopterus australis*	0.01	39.1
Mammalia	*Miniopterus gigas*	0.1072	35.6
Mammalia	*Miniopterus schreibersi*	0.01091	37.7
Mammalia	*Myotis lucifugus*	0.009	37.2
Mammalia	*Myotis myotis*	0.024	35.0
Mammalia	*Myotis sodalis*	0.007	30.5
Mammalia	*Nyctophilus geoffroyi*	0.008	31.6
Mammalia	*Plecotus auritus*	0.01	35.5
Mammalia	*Eulemur fulvus*	2.33	36.5
Mammalia	*Galago senegalensis*	0.1715	37.9
Mammalia	*Loris tardigradus*	0.284	35.5
Mammalia	*Nycticebus coucang*	1.16	35.4
Mammalia	*Otolemur (Galago) crassicaudatus*	1.8	37.1
Mammalia	*Perodicticus potto*	0.964	36.1
Mammalia	*Cheirogaleus medius*	0.3	38.0
Mammalia	*Microcebus murinus*	0.112	36.1
Mammalia	*Tarsius syrichta*	0.113	33.8
Mammalia	*Cercopithecus mitis*	8.5	37.5
Mammalia	*Colobus guereza*	10.45	37.0
Mammalia	*Erythrocebus patas*	3	39.3
Mammalia	*Macacus mulatta*	1.61	39.3
Mammalia	*Papio anubis*	9.5	37.3
Mammalia	*Papio ursinus*	16.9	37.0
Mammalia	*Aotus trivirgatus*	0.82	38.0
Mammalia	*Saimiri sciureus*	0.875	38.0
Mammalia	*Pltilocerus lowii*	0.058	36.5
Mammalia	*Tupaia glis*	0.123	37.0

Mammalia	*Orycteropus afer*	48	34.5
Mammalia	*Balaenoptera physalus*	62500	36.6
Mammalia	*Globicephala macrorhynchus*	4000	35.8
Mammalia	*Dicotyles tajacu*	20.5	37.5
Mammalia	*Hippopotamus amphibius*	1138.462	35.4
Mammalia	*Camelus dromedarius*	450	37.2
Mammalia	*Lama guanicoe*	85	38.7
Mammalia	*Alces alces*	325	38.6
Mammalia	*Odocoileus virginianus*	58.588	39.0
Mammalia	*Mazama rufina*	26	38.2
Mammalia	*Muntiacus (Cervulus) muntjac*	14.62	38.6
Mammalia	*Odocoileus hemionus*	65.771	38.3
Mammalia	*Rangifer tarandus*	20.65	39.2
Mammalia	*Giraffa camelopardalis*	400	38.5
Mammalia	*Bos taurus*	350	38.4
Mammalia	*Bubalus bubalis*	317.2	38.0
Mammalia	*Capra hircus*	18	39.5
Mammalia	*Oreamnus americanus*	90	38.6
Mammalia	*Oryx (beisa) gazella*	150	38.5
Mammalia	*Ovis aries*	25	39.4
Mammalia	*Raphicerus campestris*	9.55	39.0
Mammalia	*Syncerus caffer*	350	38.7
Mammalia	*Taurotragus oryx*	200	39.1
Mammalia	*Ceratotherium simum*	300	35.2
Mammalia	*Procavia capensis*	2.4	37.0
Mammalia	*Procavia habessinica*	2.25	38.0
Mammalia	*Procavia johnstoni*	2.75	39.0
Mammalia	*Heterohyrax brucei*	2	36.7
Mammalia	*Elephas (indicus) maximus*	1905	36.0
Mammalia	*Loxodonta africana*	5480	36.2

Supplementary Table 6. Modern reptile data used in main text Figure 1 and Figure 6.

* Calculated from mimimum and maximum values and so is not weighted to reflect the distribution of temperatures the species might have during the experimental period

Species	Mass (Kg)	Body Temp Minimum (°C)	Body Temp Maximum (°C)	Calculated Body Temp Mean (°C) *	Body Temp Variation (°C)	Notes on experimental setup	Publication	Ref. Number
Crocdylus porosus	32.00	25.0	31.0	28	6.0	Naturalistic captivity. Ingested transmitter	Grigg G.C., et al. 1998. Proc. R. Soc. Lond. B. 265:1793-1799	*52*
Crocdylus porosus	42.00	21.0	34.0	27.5	13.0	Naturalistic captivity. Ingested transmitter	Grigg G.C., et al. 1998. Proc. R. Soc. Lond. B. 265:1793-1799	*52*
Crocdylus porosus	77.00	25.0	32.0	28.5	7.0	Naturalistic captivity. Ingested transmitter	Grigg G.C., et al. 1998. Proc. R. Soc. Lond. B. 265:1793-1799	*52*
Crocdylus porosus	520.00	25.0	32.0	28.5	7.0	Naturalistic captivity. Ingested transmitter	Grigg G.C., et al. 1998. Proc. R. Soc. Lond. B. 265:1793-1799	*52*
Crocdylus porosus	520.00	30.0	33.0	31.5	3.0	Naturalistic captivity. Ingested transmitter	Grigg G.C., et al. 1998. Proc. R. Soc. Lond. B. 265:1793-1799	*52*
Crocdylus porosus	1010.00	24.0	31.0	27.5	7.0	Naturalistic captivity. Ingested transmitter	Grigg G.C., et al. 1998. Proc. R. Soc. Lond. B. 265:1793-1799	*52*
Crocdylus porosus	1010.00	30.0	34.0	32	4.0	Naturalistic captivity. Ingested transmitter	Grigg G.C., et al. 1998. Proc. R. Soc. Lond. B. 265:1793-1799	*52*
Alligator mississipiensis	1.59	15.0	29.9	22.5	14.9	Natural habitat. Surgically implanted transmitter	Seebacher, F., et al. 2003. Physiol. Biochem. Zool. 76: 348-359	*53*
Alligator mississipiensis	3.80	15.7	29.9	22.8	14.2	Natural habitat. Surgically implanted transmitter	Seebacher, F., et al. 2003. Physiol. Biochem. Zool. 76: 348-359	*53*
Alligator mississipiensis	4.10	15.7	29.9	22.8	14.2	Natural habitat. Surgically implanted transmitter	Seebacher, F., et al. 2003. Physiol. Biochem. Zool. 76: 348-359	*53*
Alligator mississipiensis	5.00	15.9	29.9	22.9	14.0	Natural habitat. Surgically implanted transmitter	Seebacher, F., et al. 2003. Physiol. Biochem. Zool. 76: 348-359	*53*
Alligator mississipiensis	15.00	16.7	29.9	23.3	13.2	Natural habitat. Surgically implanted transmitter	Seebacher, F., et al. 2003. Physiol. Biochem. Zool. 76: 348-359	*53*
Alligator mississipiensis	24.00	17.1	29.9	23.5	12.8	Natural habitat. Surgically implanted transmitter	Seebacher, F., et al. 2003. Physiol. Biochem. Zool. 76: 348-359	*53*
Alligator mississipiensis	53.64	17.8	29.9	23.9	12.1	Natural habitat. Surgically implanted transmitter	Seebacher, F., et al. 2003. Physiol. Biochem. Zool. 76: 348-359	*53*
Testudo hermanni	0.35	19.5	32.5	26.0	13	Free-ranging. Manual probe	Pulford, E., et al. 1984. Amphibia-Reptilia. 5: 37-41	*54*
Testudo hermanni	0.53	20.5	30.3	25.4	9.8	Free-ranging. Implanted probes.	Huot-Daubremont, C., et al. 1995. Amphibia-Reptilia. 17: 91-102	*55*
Testudo hermanni	0.53	21.6	31.4	26.5	9.8	Free-ranging. Implanted probes.	Huot-Daubremont, C., et al. 1995. Amphibia-Reptilia. 17: 91-102	*55*
Testudo hermanni	0.53	17.7	27.8	22.8	10.1	Free-ranging. Implanted probes.	Huot-Daubremont, C., et al. 1995. Amphibia-Reptilia. 17: 91-102	*55*
Testudo hermanni	0.53	18.3	28.4	23.4	10.1	Free-ranging. Implanted probes.	Huot-Daubremont, C., et al. 1995. Amphibia-Reptilia. 17: 91-102	*55*
Testudo hermanni	0.53	13.3	21.8	17.6	8.5	Free-ranging. Implanted probes.	Huot-Daubremont, C., et al. 1995. Amphibia-Reptilia. 17: 91-102	*55*
Testudo hermanni	0.53	14.7	20.9	17.8	6.2	Free-ranging. Implanted probes.	Huot-Daubremont, C., et al. 1995. Amphibia-Reptilia. 17: 91-102	*55*
Testudo hermanni	0.53	18.4	30.8	24.6	12.4	Free-ranging. Implanted probes.	Huot-Daubremont, C., et al. 1995. Amphibia-Reptilia. 17: 91-102	*55*
Testudo hermanni	0.53	8.0	30.0	19.0	22	Free-ranging. Implanted probes.	Huot-Daubremont, C., et al. 1995. Amphibia-Reptilia. 17: 91-102	*55*
Gopherus agassizii	2.10	21.0	38.0	29.5	17.0	In natural habitat. Transmitter.	Zimmerman, L.C., et al. 1994. Herpetological Monographs. 8: 45-59	*56*
Gopherus agassizii	2.30	24.0	38.0	31.0	14.0	In natural habitat. Transmitter.	Zimmerman, L.C., et al. 1994. Herpetological Monographs. 8: 45-59	*56*
Gopherus agassizii	2.80	24.0	35.0	29.5	11.0	In natural habitat. Transmitter.	Zimmerman, L.C., et al. 1994. Herpetological Monographs. 8: 45-59	*56*
Gopherus agassizii	3.40	23.0	35.0	29.0	12.0	In natural habitat. Transmitter.	Zimmerman, L.C., et al. 1994. Herpetological Monographs. 8: 45-59	*56*
Testudo denticulata	5.00	15.8	33.1	24.5	17.3	Laboratory. Rectal thermometer.	Benedict, F.G. 1932. Carnegie Institution of Washington Pub.	*57*
Testudo denticulata	5.00	13.3	30.5	21.9	17.2	Laboratory. Rectal thermometer.	Benedict, F.G. 1932. Carnegie Institution of Washington Pub.	*57*
Aldabrachelys gigantea	12.00	23.3	28.7	26.0	5.4	Outdoor. Used biotelemeter	Swingland, I.R., and Frazier, J.G. 1980. Pergamon press, Oxford UK	*58*
Aldabrachelys gigantea	35.00	23.3	28.3	25.8	5.0	Outdoor. Used biotelemeter	Swingland, I.R., and Frazier, J.G. 1980. Pergamon press, Oxford UK	*58*
Aldabrachelys gigantea	60.00	23.3	28.6	26.0	5.3	Outdoor. Used biotelemeter	Swingland, I.R., and Frazier, J.G. 1980. Pergamon press, Oxford UK	*58*
Aldabrachelys gigantea	12.00	28.0	32.6	30.3	4.6	Outdoor. Used biotelemeter	Swingland, I.R., and Frazier, J.G. 1980. Pergamon press, Oxford UK	*58*
Aldabrachelys gigantea	35.00	28.0	32.8	30.4	4.8	Outdoor. Used biotelemeter	Swingland, I.R., and Frazier, J.G. 1980. Pergamon press, Oxford UK	*58*
Aldabrachelys gigantea	60.00	27.9	33.7	30.8	5.8	Outdoor. Used biotelemeter	Swingland, I.R., and Frazier, J.G. 1980. Pergamon press, Oxford UK	*58*
Chelonoides nigra	170.00	28.3	32.6	30.5	4.3	Free-ranging. Ingested transmitter	Mackay, R.S. 1964. Nature. 204:355-358	*59*
Sauromalus obesus	0.10	11.0	35.0	23.0	24.0	Free-ranging. Cloacal themometer.	Case, T.J.1976. J. Herpetol. 10: 85-95	*60*
Iguana iguana	0.27	27.5	39.5	33.5	12.0	Laboratory. Cloacal themometer.	Troyer, K. 1987. Comp. Biochem. Physiol. A. 87: 623-626	*61*
Ctenosaura pectinata	0.88	24.0	42.5	33.3	18.5	Laboratory. Cloacal themometer.	Throckmorton, G. 1973. Copeia. 3: 431-435	*62*
Conolophus pallidus	4.20	25.0	37.0	31.0	12	Enclosure, hot season. Ingested transmitter.	Christian, K. 1983. Ecology. 64: 463-468	*63*
Conolophus pallidus	4.20	20.0	34.5	27.3	14.5	Enclosure, cold season. Ingested transmitter.	Christian, K. 1983. Ecology. 64: 463-468	*63*
Cyclura nubila	4.85	30.0	39.0	34.5	9	Enclosure, April. Ingested transmitter.	Christian, K. 1986. Copeia. 1: 65-69	*64*
Dipsosaurus dorsalis	0.06	28.0	40.0	34.0	12.0	Enclosure. Implanted transmitter.	McGinnis, S.M., and Dickson, L.L. Science. 156: 1757-1759	*65*
Dipsosaurus dorsalis	0.06	30.0	45.0	37.5	15.0	Enclosure. Implanted transmitter.	McGinnis, S.M., and Dickson, L.L. Science. 156: 1757-1759	*65*
Amblyrhynchus cristatus	4.00	28.0	40.0	34.0	12.0	Free-ranging. Ingested transmitter	Mackay, R.S. 1964. Nature. 204:355-358	*59*
Liolaemus multiformis	0.02	3.0	34.0	18.5	31.0	Enclosure. Implanted transmitter.	Pearson, O.P. and Bradford, D.F. 1976. Copeia. 1: 155-170	*66*
Varanus varius	4.20	17.8	38.2	28.0	20.4	Free-ranging. Implanted transmitter.	Stebbins, R.C., and Barwick, R.E. 1968. Copeia. 3: 541-547	*67*
Varanus salvator	7.80	27.0	32.0	29.5	5.0	Free-ranging. Cloacal thermometer.	Wikramanayake, E. D., and Green, B. 1989. Biotropica. 21: 74-79	*68*
Varanus tristis	0.27	17.0	35.0	26.0	18.0	Enclosure. Implanted transmitter.	Thompson, G.G., et al. 1999. Aus. J. Ecol. 24: 117-122	*69*
Hypssilurus spinipes	0.06	11.0	21.0	16.0	10.0	Free-ranging. Transmitter on tail.	Rummery, C. et al. 1995. Copeia. 1995. 818-827.	*70*
Varanus komodoensis	12.00	27.5	40.0	33.8	12.5	Enclosure. Cloacal thermometer.	McNab, B. K., and Auffenberg, W. 1976. Comp. Biochem. Physiol. A. 55: 345-350	*71*
Morelia spilota	2.50	13.0	32.0	22.5	19.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	15.0	34.0	24.5	19.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	15.0	31.0	23.0	16.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	21.0	32.0	26.5	11.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	21.0	31.5	26.3	10.5	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	19.0	29.0	24.0	10.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	22.0	30.0	26.0	8.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	21.0	29.0	25.0	8.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	21.0	24.0	22.5	3.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	20.0	25.0	22.5	5.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota	2.50	19.0	27.0	23.0	8.0	Free-ranging. Implanted transmitter.	Slip, D.J., and Shine, R. 1988. Copeia. 4: 984-995	*72*
Morelia spilota imbricata	10.00	7.0	12.0	9.5	5.0	Free-ranging. Implanted transmitter.	Pearson, D., et al. 2003. J Therm. Biol. 28: 117-131	*73*
Morelia spilota imbricata	10.00	15.0	27.0	21.0	12.0	Free-ranging. Implanted transmitter.	Pearson, D., et al. 2003. J Therm. Biol. 28: 117-131	*73*
Morelia spilota imbricata	10.00	18.0	33.0	25.5	15.0	Free-ranging. Implanted transmitter.	Pearson, D., et al. 2003. J Therm. Biol. 28: 117-131	*73*
Morelia spilota imbricata	10.00	15.0	30.0	22.5	15.0	Free-ranging. Implanted transmitter.	Pearson, D., et al. 2003. J Therm. Biol. 28: 117-131	*73*
Morelia spilota imbricata	10.00	15.0	26.0	20.5	11.0	Free-ranging. Implanted transmitter.	Pearson, D., et al. 2003. J Therm. Biol. 28: 117-131	*73*

Supplementary.Table 7: Heated gas lines and secondary transfer function slope and intercept used for calculating clumped isotope values on absolute reference frame.

	HG		STF	
	slope	intercept	slope	intercept
Ostrich egg	0.0086	-0.8027	1.038068182	0.0266
Swann Egg	0.0086	-0.8027	1.038068182	0.0266
Penguin Egg	0.0086	-0.8027	1.038068182	0.0266
Alligator Egg Old	0.0086	-0.8027	1.038068182	0.0266
Am. Crocodile Egg	0.0086	-0.8027	1.038068182	0.0266
Nile Crocodile Egg	0.0086	-0.8027	1.038068182	0.0266
Turtle Egg	0.0086	-0.8027	1.038068182	0.0266
Am. Croc. II	0.0086	-0.8027	1.038068182	0.0266
Turtle II	0.0086	-0.8027	1.038068182	0.0266
Nile Croc II	0.0086	-0.8027	1.038068182	0.0266
Penguin II	0.0086	-0.8027	1.038068182	0.0266
Swan II	0.0086	-0.8027	1.038068182	0.0266
Pipilo erythrophtalmus	0.0185	-0.762	1.047550686	0.0266
Sayornis phoebe	0.0185	-0.762	1.047550686	0.0266
Vanellus miles	0.0185	-0.762	1.047550686	0.0266
Gallus gallus domesticus	0.0185	-0.762	1.047550686	0.0266
Odontophorus melanotis	0.0185	-0.762	1.047550686	0.0266
Irena puella	0.0185	-0.762	1.047550686	0.0266
Columba livia	0.0185	-0.762	1.047550686	0.0266
Cathartes aura	0.0185	-0.762	1.047550686	0.0266
Struthio camelus	0.0185	-0.762	1.047550686	0.0266
Cygnus atratus	0.0185	-0.762	1.047550686	0.0266
Tyto alba	0.0185	-0.762	1.047550686	0.0266
Dromaius novaehollandiae	0.0185	-0.762	1.047550686	0.0266
Spheniscus magellanicus	0.0185	-0.762	1.047550686	0.0266
Varanus gouldii	0.0185	-0.762	1.047550686	0.0266
Geochelone radiata	0.0185	-0.762	1.047550686	0.0266
Alligator mississippiensis	0.0185	-0.762	1.047550686	0.0266
Crocodylus acutus	0.0185	-0.762	1.047550686	0.0266
Chelonoidis nigra	0.0185	-0.762	1.047550686	0.0266
Podocnemis sp.	0.0185	-0.762	1.047550686	0.0266
Pantherophis guttatus	0.0185	-0.762	1.047550686	0.0266
Crocodylus niloticus	0.0185	-0.762	1.047550686	0.0266
Heloderma horridum exasperatum	0.0185	-0.762	1.047550686	0.0266
1_1	0.0086	-0.8027	1.038068182	0.0266
1_2	0.0086	-0.8027	1.038068182	0.0266
2_1	0.0086	-0.8027	1.038068182	0.0266
2_2	0.0086	-0.8027	1.038068182	0.0266
3_1	0.0086	-0.8027	1.038068182	0.0266
3_2	0.0086	-0.8027	1.038068182	0.0266
4_1	0.0086	-0.8027	1.038068182	0.0266
4_2	0.0086	-0.8027	1.038068182	0.0266
5	0.0086	-0.8027	1.038068182	0.0266
6	0.0086	-0.8027	1.038068182	0.0266
7_1 (7)	0.0086	-0.8027	1.038068182	0.0266
7_2 (8)	0.0086	-0.8027	1.038068182	0.0266
7_3 (9)	0.0086	-0.8027	1.038068182	0.0266
10	0.0086	-0.8027	1.038068182	0.0266
11	0.0086	-0.8027	1.038068182	0.0266
12	0.0086	-0.8027	1.038068182	0.0266
13	0.0086	-0.8027	1.038068182	0.0266
Rousset A1	0.0086	-0.8027	1.038068182	0.0266
Rousset A2	0.0086	-0.8027	1.038068182	0.0266
Rousset B1	0.0086	-0.8027	1.038068182	0.0266
Rousset B2	0.0086	-0.8027	1.038068182	0.0266
Rousset C1	0.0086	-0.8027	1.038068182	0.0266
Rousset C2	0.0086	-0.8027	1.038068182	0.0266
Rousset D1	0.0086	-0.8027	1.038068182	0.0266
Rousset D2	0.0086	-0.8027	1.038068182	0.0266
AUCA L4 16	0.006722348	-0.898729531	1.068485021	-0.00033284
AUCA L4 17	0.006722348	-0.898729531	1.068485021	-0.00033284
AUCA L4 18	0.006722348	-0.898729531	1.068485021	-0.00033284
AM Sediment	0.0086	-0.8027	1.038068182	0.0266

Totesti: R2 Nemegtosaur	0.006722348	-0.898729531	1.068485021	-0.00033284
NAT VAD Bird 1	0.006722348	-0.898729531	1.068485021	-0.00033284
Romanian Travertine	0.006722348	-0.898729531	1.068485021	-0.00033284
AMNH 1189	0.0086	-0.8027	1.038068182	0.0266
AMNH 1188	0.0086	-0.8027	1.038068182	0.0266
AMNH Partial egg	0.0086	-0.8027	1.038068182	0.0266
AMNH 1062	0.0086	-0.8027	1.038068182	0.0266
AMNH 1063	0.0086	-0.8027	1.038068182	0.0266
AMNH UT03	0.0086	-0.8027	1.038068182	0.0266
AMNH 1066	0.0086	-0.8027	1.038068182	0.0266
AMNH 1060	0.0086	-0.8027	1.038068182	0.0266
AMNH Loose shell frag	0.0086	-0.8027	1.038068182	0.0266
DJADOKHTA SPAR	0.006722348	-0.898729531	1.068485021	-0.00033284
Nodule 1	0.0119	-0.7776	1.038068182	0.0266
Nodule 2	0.0119	-0.7776	1.038068182	0.0266
Nodule 3	0.0119	-0.7776	1.038068182	0.0266
Nodule 4	0.0119	-0.7776	1.038068182	0.0266
Nodule 5	0.0119	-0.7776	1.038068182	0.0266
Nodule 9	0.0119	-0.7776	1.038068182	0.0266
Nodule 3	0.0119	-0.7776	1.038068182	0.0266
Nodule 11	0.0119	-0.7776	1.038068182	0.0266
Nodule 14	0.0119	-0.7776	1.038068182	0.0266
FR94_031_RH.1 (ES)	0.0119	-0.7776	1.038068182	0.0266
FR94_01_RH.2 (ES)	0.0119	-0.7776	1.038068182	0.0266
FR94_031_RH.3 (ES)	0.0119	-0.7776	1.038068182	0.0266
FR94_032_RH.1	0.0119	-0.7776	1.038068182	0.0266
FR94_032_RH.2	0.0119	-0.7776	1.038068182	0.0266
FR94_035_RH.2	0.0119	-0.7776	1.038068182	0.0266
FR94_036_RH.1	0.0119	-0.7776	1.038068182	0.0266
FR_94_036_RH.2	0.0119	-0.7776	1.038068182	0.0266
FR94_040_RH.1	0.0119	-0.7776	1.038068182	0.0266
FR_94_040_RH.2	0.0119	-0.7776	1.038068182	0.0266
B. Tsav Eg	0.0119	-0.7776	1.038068182	0.0266
Shaena UT13 Eg	0.0119	-0.7776	1.038068182	0.0266
Shaena BB08 Eg	0.0119	-0.7776	1.038068182	0.0266
Shaena 1150 Eg	0.0119	-0.7776	1.038068182	0.0266
Shuvucia Bone	0.0119	-0.7776	1.038068182	0.0266

Supplementary Note 1. Description of specimens

Modern eggshells

Modern eggshell specimens were obtained from a number of sources. Radiated Tortoise and beaded lizard eggshells were provided by the Los Angeles Zoo. Ostrich eggshells were obtained from Gemarkenhof Farm near Remagen in Germany. Black swan, Magellanic penguin, American crocodile, corn snake, argus monitor, bearded dragon, and turtle eggshells were obtained from the San Francisco Zoo. *Alligator mississippiensis* eggshells were obtained from Colorado Gators, a reptile park in Mosca, Colorado. *Dromaius novaehollandiae, Tyto alba, Cathartes aura, Sayornis phoebe,* and *Pipilo erythrophtalmus* were provided by the Western Foundation of Vertebrate Zoology and were collected in the wild. The Zurich Zoo provided a Galapagos tortoise eggshell. *Vanellus miles*, *Irena puella*, and *Odontophorus melanotis* were from South Carolina Zoo. The remaining specimens were obtained from personal collections. All eggshells are calcitic except for the tortoise and turtle eggshells that are aragonitic.

Specimens from the Nemegt Basin, Mongolia

Late Cretaceous specimens were recovered from the Nemegt Basin, Mongolia. Details on the geologic setting and specimens can be found in several publications[2-10] and are summarized here. Specimens for this study are from one of three localities: Ukhaa Tolgod, Bayn Dzak, or Bugin Tsav. Ukhaa Tolgod and Bayn Dzak are assigned to the Campanian Djadokhta Formation [1], whilst Bugin Tsav is assigned to the late Campanian to Maastrichtian Nemegt Formation. Assemblages including nesting individuals found in association with eggs as well as fossil embryos from the Djadokhta Formation[2,3] indicate eggshells are oviraptorid. Oviraptorid eggshells have been assigned to the parataxonomic family Elongatoolithidae[2,4,5]. At Ukhaa Tolgod the precise assignment of eggshells to the species *Citipati osmolskae* is possible due to the discovery of specimens in brooding positions on nests, whereas at Bayn Dzak and Bugin Tsav, the eggshells share the same characteristics as the specimens from Ukhaa Tolgod. A second eggshell morphotype is present in the same formations but identifying fossils have not been discovered in association, therefore here we describe these specimens as Djadokhta Morphotype 2.

Sediments at Ukhaa Tolgod and Bayn Dzak exhibit similar lithologies; fine-grained sandstones with evidence for arid and semi-arid conditions including indications of a dune system, with dune migration and vertebrate fossils preserved in death positions possibly indicating that they were rapidly buried[6]. Calcite sheets and nodular carbonates indicate the ephemeral presence of water in the dune system. Nodular soil carbonates are also found at the same site, and are paleosol carbonates and/or early diagenetic concretions as some are found nucleated around vertebrate fossils[7]. In either case, the nodular carbonates might reasonably be expected to reflect earth surface conditions at the time and have $\delta^{18}O$ values consistent with formation in meteoric waters (Supplementary Table 3). In contrast, the Nemegt Formation at Bugin Tsav is predominated by fluvial sediments as evidenced by very fine-grained sandstone and ripple structures amongst others lines of evidence described elsewhere[8–10]. Specimens analyzed have been catalogued at the American Museum of Natural History, and are referred to by their catalogue number, whilst others are known by their field designations (UT03, UT13, Partial Egg, Loose shell frag., BB08, and B.Tsav Egg).

Specimens from Neuquén Province, Argentina

The fossil-bearing locality Auca Mahuevo exhibits outcrops of the Anacleto Member of the Río Colorado Formation in Neuquén Province, Argentina[11]. The age of the section is considered to be early or middle Campanian in age[11]. Details on the geologic setting and specimens can be found in publications[6,11-13,15-16] and are summarized here. Briefly, fossilized eggs are contained in a 5-meter layer of mudstone to siltstone and were probably buried by silt during flooding of nearby streams[11]. Taxonomic assignment of eggshells to titanosaurid dinosaurs is possible due to the discovery of embryos of sauropod dinosaurs at this site[12]. Four distinct sedimentological layers were found to bear eggshell fossils at this site and although the first reports of Auca Mahuevo nesting site implied a monotaxic titanosaur assemblage, further refined to nemegtosaurid titanosaur[13]. One of the co-authors (GGT) has determined that the egg-laying titanosaurs in layer 4 may represent a different nemegtosaurid species, certainly closely related to those nesting in layers 1-3 but displaying sufficient autapomorphies to justify a species variation. A modern analogue would be the megapode family in Australasia with for instance the mound builders *Alectura lathami*[14] nesting in wetter environments in coastal Australia regions in contrast to its contemporaneous congener *Leipoa ocellata* that nest in outbacks and semi-desertic settings[15]. These ecological differences may also relate to fossil preservation (see below). Celestite geodes and barite crystals are frequently found in layers 1-316. These two minerals can be produced in evaporitic and geothermal settings, both equally possible at Auca Mahuevo due to its particular geology 6. Auca Mahuevo samples are archived in the Los Angeles County Museum with specimen numbers LACM 7299/147514 and LACM 7324/148396.

Specimens from the Provence Basin, France

Cretaceous dinosaur eggshells from the Provence Basin in France were examined. Specimens are archived in the Goldfuß Museum of the University of Bonn. Details on the geologic setting and specimens can be found in publications[17-19] and are summarized here. Eggshells have been previously been linked to the titanosaurid sauropod genus *Hypselosaurus* due to the discovery of contemporaneous skeletal fossils and are considered of the parataxonomic group Megaloolithidae[17,18]. However, as no embryos or identifiable fossil assemblages have been found in association with nests these eggshells must be considered "putative titanosaurid".

Specimens from two sections (Roques Haute and Rousset) were studied. These sections are considered to be roughly contemporaneous and cover much of the Maastrichtian; detailed synthesis of stratigraphic work on the relevant sections can be found in elsewhere[19]. Eggshells and nodular paleosol carbonates from the Roques Hautes section are described in detail by a previous study[19]. Eggshell specimens from a second Rousset section have been also been studied previously[18]. To aid in comparison to published work, we refer to the Rousset specimens as being from horizons A-D[18], where horizon D is from the upper Maastrichtian (proximal to the K/T boundary) and horizon A is the lowermost eggshell-bearing layer in the section. The Roques Hautes section is considered to be have been deposited in a floodplain environment dominated by open vegetation whereas the Rousset section has been considered to be in a main channel belt primarily covered by riparian forest[19]. Hence there is the potential for differences in both fossil preservation and dinosaur paleoecology between the two sites.

Specimens excluded from discussion in main text

Single eggshells from that have been putatively identified as titanosaurid (parataxonomic group Megaloolithidae*)* from the Coll de Nargó in Spain, and Ariège in France were analyzed (Supplementary Table S4). In addition, Faveoolithid eggshells from Rio Negro in Argentina and Ningxia in Mongolia were analyzed, as well as a Spheroolithid eggshell specimen from Montana (Supplementary Table 3). In the case of specimens from Coll de Nargó and the Nanxiong Basin, Δ_{47} temperatures of approximately 55-65°C indicate significant diagenesis on burial of the specimens had occurred. As temperatures were not physiologically plausible, no further work was attempted on material from these sites. Thin sections of specimens from Ningxia and Rio Negro indicated substantial dissolution and replacement of the specimens had occurred (Supplementary Figure 2) and so we choose to conduct further geochemical analyses. These findings for the Coll de Nargó and Rio Negro specimens are congruent with previous interpretations[20,21]. The specimen from Ariège was not discussed in the main text simply because we had a much larger comparative sample set of eggshell and pedogenic soil carbonates from Rousset and Roques Hautes in Provence that allowed us to characterize preservation and address diagenesis in more detail. All specimens are archived in the Goldfuß Museum of the University of Bonn or the Museum of the Rockies in the case of the samples from Montana.

Supplementary Note 2: Δ_{47}-temperature calibrations

The relationship between measured Δ_{47} values and the temperatures of the fluids from which carbonates precipitate was originally defined in the Caltech lab using a series of laboratory grown calcites[25]. These experiments produced the following equation:

$$\Delta_{47} = 0.0592\ (10^6.T^{-2}) - 0.02 \qquad \text{(Equation 1)}$$

Where temperature is in Kelvin (K).

Subsequently there has been more work done to refine methods and calibrations[22-37,39]. More recently Δ_{47} values are reported in an absolute reference frame (ARF) defined by analyzing both heated gases and water equilibrated gases[26]. For data that was collected before water equilibrated gases were run routinely, a transfer function can be used to report data on the new reference frame based on accepted values of carbonate standards[26]. Using this method the original calcite calibration given by equation 1 was converted to:

$$\Delta_{47} = 0.0636\ (10^6.T^{-2}) - 0.0047 \qquad \text{(Equation 2)}$$

Δ_{47} calibration studies on biogenic calibration materials such as foraminifera, coccolithophores, corals, brachiopods, teeth, and otoliths have also been carried out[25,27–31]. It has been noted that whilst yielding a relationship between measured Δ_{47} values and mineral formation temperatures that is very similar to the inorganic calcite calibration line, when they are combined the data from biogenic materials support a calibration slope that is slightly shallower than the original inorganic calcite calibration[32] on the ARF scale:

$$\Delta_{47} = 0.0559\ (10^6.T^{-2}) + 0.0708 \qquad \text{(Equation 3)}$$

In order to derive this slope Eagle et al., excluded data from fast growing surface water *Porites* corals that appear to express kinetic isotope effects due to their high growth rate[25,33] as well as data from recent mollusk and brachiopod calibration studies which yield calibration slopes that are significantly different from other materials analyzed[32,34].

We note that shallower calibration slopes have been reported in several studies[26, 32, 34, 35, 37,89] and that understanding the source of these calibration differences is an area of active research. A shallower slope was derived from theoretical studies of ^{13}C-^{18}O "clumping" that combined models of acid digestion fractionations[35,36]. Mollusk calibration studies also exhibit a shallower calibration slope[32,34], as have some synthetic calcite calibrations[89,90]. A calibration study utilizing synthetic carbonates derive a much shallower slope[89].

$$\Delta_{47} = 0.0387\ (10^6.T^{-2}) + 0.2532 \qquad \text{(Equation 4)}$$

In contrast, a recent study by Zaarur and colleagues (2013) also focused on synthetic carbonates reported a steep calibration slope[78] similar to equations 1-3 (Table S1-S3). Just using carbonates grown in their study, we calculate the following calibration equation:

$$\Delta_{47} = 0.0544\ (10^6.T^{-2}) + 0.0911 \qquad \text{(Equation 5)}$$

Reconciling these calibrations is beyond the scope of this study, however we note that Δ_{47} derived temperatures from eggshells most closely match known body temperatures when any of the calibrations with a steep slope are used (the Ghosh et al., 2006 or Zaarur et al., 2013 or Caltech biogenic calibration) (Table 1 and S2). Plausible bird and reptile body temperatures are not reconstructed when calibrations using shallower slopes are used (e.g., Equation 4), as shown in Table S1. Therefore whilst Δ_{47} calibrations remain largely empirical the calcite eggshells studied here appear to be equivalent to the majority of biogenic material studied to date (Figure 1) and suggest that shallower slope calibrations may not apply to all biogenic materials analyzed at Caltech with the same experimental setup and during similar analytical time periods (2008-2015).

Eggshell calibration

Expected body temperatures of eggshell mineralization are taken from the literature[52, 54, 57, 60, 75-76, 79-88], see also Supplementary Tables 5-6. Figure 1 shows that a regression through the modern eggshell data yields the following relationship:

$$\Delta_{47} = 0.0493 \pm 0.0043\ (10^6.T^{-2}) + 0.1393 \pm 0.0447$$

These results are similar to published calibrations for synthetic carbonates and other biogenic carbonates. Using the same ANCOVA tests we described in another publication[32], we find that the slope of the eggshell calibration is not statistically different from either the Caltech biogenic calibration ($p = 0.680$) or the calibrations of Zaarur et al., 2013 ($p = 0.556$) or Ghosh et al., 2006 ($p = 0.227$). When shallower sloped calibration of Tang et al., 2014[89] is compared we find that there is a statistically difference in their slopes ($p = 0.0001$).

Supplementary Table 1-3 shows calculations of body temperature using the eggshell calibration and other steep slope calibrations. Whilst it would be possible to use this eggshell calibration to calculate body temperatures for ancient organisms, we favor using the other calibrations because there are significant uncertainties for certain ectotherms derived from not knowing exactly when the animals mineralize their eggshells. This stands in contrast to other clumped isotope studies of biominerals that include data for organisms grown in aquariums at a constant temperature and in relatively invariant temperature environments, and of synthetic carbonates grown under narrowly controlled conditions. As the Caltech biogenic calibration is the most data-rich calibration and therefore has the smallest uncertainty in slope we chose to utilize this as the primary calibration in figures.

Supplementary Note 3: Assessment of fossil eggshell preservation

As we have demonstrated the utility of our approach in modern eggshells the preservation of geochemical signatures in fossils specimens is the key uncertainty in clumped isotope based reconstructions of body temperatures. Two modes of diagenesis are potential confounding factors on interpreting ^{13}C-^{18}O bond abundance in carbonates, firstly conventional isotope exchange with environment fluids leading to secondary calcite precipitation and secondly solid state reordering of ^{13}C-^{18}O bond ordering within the solid calcite mineral lattice. Solid state reordering does not involve altering the bulk geochemical signature of the mineral. However initial studies have suggested that very old carbonates can preserve coherent ^{13}C-^{18}O isotope signatures even over 100Ma timescales[27,37,42]. In addition ^{13}C-^{18}O bond reordering is favored at high temperatures and so evidence from either isotopic compositions or stratigraphic constraints that a section has not been deeply buried and subjected to high temperatures is desirable to reduce the potential for solid state reordering.

Dissolution and reprecipitation of carbonates can be diagnosed through a number of approaches and here we utilize a hierarchy of methods. Firstly eggshell specimens were examined petrographically including by light microscopy and cathodoluminescence (CL) on thin sections and scanning electron microscopy (SEM), electron backscatter diffraction (EBSD), and energy dispersive spectroscopy (EDS) analysis on eggshell fragments[20]. Secondly, in addition to analyzing the geochemistry of eggshells wherever possible we analyzed both nodular carbonates (either early diagenetic concretionary nodules or pedogenic soil carbonate nodules), spar calcites associated with fossils, bone fragments, or if none of those was available bulk sediment from the strata from which fossils were recovered. Most of these additional materials would be predicted to reflect the diagenetic history of the strata containing eggshells and so resolving geochemical differences between eggshells and other materials is one way of deriving information of the preservation state of the primary fossils of interest. Both materials that reflect early diagenesis (e.g. altered bone, concretionary carbonates) as well as pedogenic soil carbonate nodules have the potential to reflect surface temperatures and meteoric water compositions of the time, however it can of course also reflect alteration at a later stage. When considering stable isotope effects one might expect in perfectly unaltered samples that soil carbonates (and if altered, early diagenetic materials) would reflect environmental temperatures and meteoric waters whereas vertebrate fossils could be expected to be offset from these values based on dietary and physiological effects of body water compositions, which have been found to be enriched by at least several per mil compared to drinking water[43,44] as well as the potential for animal migration from one environment to another. This is particularly true for herbivorous animals that consume large quantities of vegetation that is isotopically enriched compared to meteoric waters[45,46]. When considering trace element compositions, recrystallization and diagenesis of carbonates is often associated with the reprecipitation of secondary carbonates with higher concentrations of elements like manganese, iron, and lithium[19,41], although the effects are entirely dependent on the composition of fluids and the sedimentary setting at a particular location.

As discussed in the main text, each approach has its strengths and weaknesses. Petrographic and SEM analysis is very effective at diagnosing localized diagenetic features but is limited to only the part of the sample that is sectioned. Bulk geochemistry has the advantage of assessing the entirety of the sample, but conversely can be difficult to detect alteration of a minor component and impossible to diagnose alteration in fluids closely matching those of original composition. We discuss our assessment of the preservation of samples from each site below. The emphasis of our approach is to produce a consistent answer across different analyses. In some cases where there was not enough information to be certain, or one indicator suggests a different preservation state compared to another we take a conservative approach and consider the specimens of uncertain or poor preservation.

Preservation of specimens from the Nemegt Basin, Mongolia

The stable isotope compositions of specimens from this site revealed evidence for significant differences in preservation both between different eggshells and between eggshells and other materials recovered from the same site (Supplementary Figure 4). Nodular carbonate concretions at the Ukhaa Tolgod site as well as diagenetic phases such as altered bone and sparry calcite yield values of mineral formation water $\delta^{18}O$ of -7 to -10‰ (V-SMOW; Supplementary Figure 4, Table S3). These depleted values are consistent with formation in meteoric waters and probably reflects earth surface conditions soon after deposition. In contrast oviraptorid eggshells exhibited a large range in calculated mineral formation water $\delta^{18}O$, ranging from approximately 2‰ to -8‰ (V-SMOW; Supplementary Figure 4, Table S3). The fact that specimens are recovered from different sites could explain at least part of this variability, but it is also likely that differential preservation of samples is a significant factor. All four eggshells from the Bugin Tsav and Bayn Dzak localities yield depleted water $\delta^{18}O$ values of -5 to -8‰ (Supplementary Table 3). At face value, this would appear to indicate recrystallization of these specimens in meteoric waters, but could also be the result of different environments and meteoric waters in these localities compared to Ukhaa Tolgod. However we do not have non-eggshell materials available from Bugin Tsav and Bayn Dzak to give geochemical perspective to these specimens and so we have categorized them as being of uncertain preservation, despite apparently good preservation indicated by petrography (discussed below).

The large offset in water $\delta^{18}O$ between three of the five eggshell specimens from Ukhaa Tolgod and other materials analyzed must represent differences in preservation. As materials such as spar calcite and bone yield depleted values, and the eggshells do not (Supplementary Figure 4; Supplementary Table 3), this suggests that these eggshell specimens have not been altered in the same waters, which are likely meteoric based on the similarity to carbonate nodule compositions.

We considered three eggshell specimens (sample IDs UT03, Loose shell frag, and

UT13; Supplementary Table 3) that have water $\delta^{18}O$ values of ~1 to 2‰ to have the best preservation of all the eggshell specimens from this site. Body waters that are enriched from meteoric water are consistent with a partially herbivorous diet. Ukhaa Tolgod oviraptorid eggshell specimens IGM 100/1188 and Partial Egg had water $\delta^{18}O$ values that were intermediate (Supplementary Table 3) between the best-preserved samples and the inferred meteoric composition of early diagenetic phases, which could reflect partial recrystallization. The four Djadokhta Morphotype 2 specimens had water $\delta^{18}O$ values in the range of 0 to 2‰ (Supplementary Figure 4; Supplementary Table 3) and are geochemically distinct from diagenetic phases.

Petrographic examination of eggshell specimens revealed apparently good preservation of all oviraptorid specimens (Supplementary Figure 1). Typically, specimens are 0.6-1.8 mm thick with prominent linearituberculate ornamentation and consist of two structural layers of calcite, as also described previously[5,47,48]. Pore canals are small and extremely rare in these eggshells, with only one visible on SEM analysis of all the specimens (Supplementary Figure 1). The low number of pore canals and their small size reduces concerns of infilling of secondary calcite affecting measured stable isotope values and also means that they will not act as foci for dissolution/alteration as is seen in other specimens (for example the titanosaurids from the Provence Basin described below). Cathodoluminescence did not reveal any evidence of alteration, consistent with the trace element analysis discussed below. Petrographic inspection of thin sections and by SEM reveal some evidence for remineralization of the outer eggshells surface, which does not exhibit by cathodoluminscence. However as this layer is relatively thin and is not accompanied by dissolution/reprecipitation of the main eggshell structure it is highly likely to be removed by the sample preparation steps outlined above, where the outer surfaces are drilled away before the remainder of the eggshell is powdered for geochemical analysis.

EBSD analysis on Oviraptorid eggshells from Ukhaa Tolgod yielded a consistent picture. None of the specimens analyzed showed evidence for significant recrystallization in section (Figure 4), although it is important to note the section analyzed may not capture recrystallization in other areas of the shell. However all specimens analyzed also show some evidence consistent with crystal deformation likely due to compression of the eggshells on burial. In diffraction and crystallographic maps, the crystal edges are irregular and distorted, except at the cones on the top panels of Figure 2 and the outermost crystals on the middle panels of Figure 4. This is reflected by a spreading of poles on the projection of the {0001} plane of calcite. As discussed in the main text, it is unclear whether this type of crystal deformation would impact isotope clumping signature. The relatively (compared to other sites) heavy Δ_{47} values corresponding to temperatures clustering around 28-30°C for materials from this site is not indicative of a widespread loss of ^{13}C-^{18}O bond ordering due to compression. Therefore we note this feature of these eggshells but do not exclude them as altered.

Djadokhta Morphotype 2 specimens were not considered in detail in the main text, as they do not have precise taxonomic assignation as no associated embryos have been found. In addition they generally show poorer preservation than the oviraptorid eggshells. SEM and EDS characterization indicate dissolution and replacement of the original eggshell by spar calcite, particularly between nucleation sites and the inner shell surface (Supplementary Figure 1), although the latter is likely removed by sample preparation. Pores display dissolution along their inner margins that often extends into the adjacent shell units; the pores are often observed to be in-filled by secondary sparry calcite, a crucial difference compared to the oviraptorid eggshells. The difference in preservation between the two eggshell types is interesting given that they are recovered from the same strata. However, localized differences in preservation depending on different nesting environments are possible. In addition differences in structure between eggshells such as contrasting organic contents, pore canal size and pore canal frequency could also contribute to one eggshell type being better preserved than another.

Unlike the samples from the Provence Basin and Auca Mahuevo (described below) comparative trace element data collected on eggshells, soil carbonates, diagenetic spar calcites, and bone at this site did not reveal clear indications on sample preservation as known diagenetic phases (spar calcites and bone) as well as nodular carbonates had similar and overlapping element/calcium ratios to eggshells (Supplementary Figure 1). As trace element contents of diagenetic phases and carbonate nodules were also generally low compared to other sites we did not take this as an indication that all materials were equally altered – which would also be inconsistent with other observations made above – but rather that diagenetic fluids of this site had relatively low levels of these elements and so secondary carbonate precipitates would not exhibit elevated elemental contents and so these measurements could not be easily used as diagnostics of preservation.

Δ_{47}-derived temperatures from materials at these sites range from 15-38°C (using calibration equation 3; Supplementary Table 3). Interestingly the average temperature of ~26°C for the 9 nodular carbonates from Ukhaa Tolgod is significantly lower than the average Δ_{47} temperature of 31.0°C for all five Ukhaa Tolgod oviraptorid eggshells, as well as the temperature of 31.9°C for the three Ukhaa Tolgod oviraptorid eggshells that were judged best preserved and the temperature of 32.9°C for Djadokta Morpohtype 2 eggshells (Table 2; Supplementary Table 3). Spar calcite yielded a Δ_{47} temperature of 27.6°C, also lower than eggshells. These observations are significant as they show that eggshell Δ_{47} signatures have not been affected by recrystallization under the same conditions as other materials at this site. Also if nodular carbonate concretions reflect environmental temperatures at the site then it is evident that dinosaur body temperatures were elevated above environmental temperatures, which has not been shown before. This conclusion would be further strengthened if the nodular carbonates at this site reflect average summertime temperatures as pedogenic soil carbonate nodules Δ_{47} values are thought too [22].

In conclusion we find no evidence for significant diagenesis of three of the five Mongolian oviraptorid specimens from Ukhaa Tolgod, and consider them apparently well preserved. The remaining two oviraptorid specimens from Ukhaa Tolgod were considered to be of poor or uncertain preservation as their isotopic composition was more similar to diagenetic phases recovered from the site. Djadokta Morphotype 2 were considered to be of uncertain preservation due to petrographic evidence of alteration even though they were isotopically offset from diagenetic phases, and eggshells from Bugin Tsav and Bayn Dzak were considered of uncertain preservation as the calculated water $\delta^{18}O$ values of these samples are similar to diagenetic phases (Supplementary Table 3).

Preservation of specimens from Neuquén Province, Argentina

Titanosaurid eggshells from the Auca Mahuevo locality in Neuquén Province, Argentina were examined from two of the four fossil bearing horizons, layer 2 and layer 4. $\delta^{13}C$ values were similar between eggshells of the same layer but mineral $\delta^{18}O$ and calculated water $\delta^{18}O$ are slightly offset by ~0.5‰ (Supplementary Table 3, Supplementary Figure 5). Calculated body waters of 5-6‰ (V-SMOW; Supplementary Table 3) are plausible for a very large herbivore: they are enriched compared to meteoric waters, and are similar to values calculated from Jurassic sauropod tooth enamel[49]. Eggshells from both layers are isotopically distinct in compositions from bulk sediment from the site (Table S3).

Petrographic and trace element analysis support a significant difference in preservation between eggshell-bearing layers 2 and 4. It has previously been noted that specimens from Level 2 often show ubiquitous evidence of dissolution on both external and internal surfaces[5,47], with obvious enlargements of the basal-most horizontal pore network that exhibit secondary calcitic infilling unlike specimens from eggshell bearing layer 4 which generally show less alteration[21,47,48]. Our analysis of layer 2 specimens typically supports these observations (Supplementary Figure 2), with extensive sparry calcite found predominantly between eggshell nucleation sites and near the eggshell surfaces which often also display florescence under cathodoluminescence (Supplementary Figure 2). Cathodoluminescence also highlights secondary calcite precipitation along some, but not all, pore canals but pores were not completely infilled with secondary carbonate. In general layer 4 specimens exhibited less extensive dissolution/reprecipitation on the underside of the specimens from layer 2 (Supplementary Figure 3), to the extent that it would be reasonable to assume that the majority of secondary calcite would be removed by the sample preparation steps. EDS analyses reveal frequent influx of silica-rich clay into pore canals, but no wide-spread infilling with secondary carbonate (Supplementary Figure 3).

EBSD[40] was a very instructive approach to analyzing Auca Mahuevo eggshells. As shown in Figure 3, EBSD analysis revealed that Auca Mahuevo layer 2 eggshells were heavily recrystallized. In these specimens each calcite crystal presents a different orientation and without a preferred orientation of the *c*-axis of calcite (Figure 3). The diffraction maps (Figure 3) shows regular edges of calcite crystals, defining prisms, which would suggest that the recrystallization is predominantly due to closed-system replacement rather than open system dissolution and precipitation of secondary calcite. In contrast layer 4 eggshells showed excellent preservation (Figure 3), with secondary calcite localized to the interior of the eggshell between the cone structures. This area is likely removed by drilling when eggshells are prepared for stable isotope analysis.

Li/Ca for layer 2 eggshells are markedly higher compared to layer 4 eggshells (33 versus 9.3 μmol/mol), whilst average Mn/Ca (0.54 versus 0.40 mmol/mol) and Mg/Ca

(6.1 versus 5.0 mmol/mol) are more marginally higher (Supplementary Table 3, Supplementary Figure 5). There is a strong correlation between Δ_{47} temperature and Li/Ca in all specimens. Whilst not clearly diagnostic these observations are consistent with petrographic observations supporting better preservation of layer 4 specimens compared to layer 2. The trace element composition of eggshells of both layers was distinct from the sedimentary matrix (Supplementary Table 3, Supplementary Figure 5).

Celestite geodes and barite are ubiquitous in Auca Mahuevo Layers 1-3 but not layer 4[16], and are known to be associated with geothermal and evaporitic settings. This may be relevant for the differing trace element content and preservation between layer 2 and 4 samples. The difference in preservation between the two layers is subtle, but does seem consistent across the multiple approaches taken. Therefore on the basis of trace element data, EBSD and petrography we considered layer 4 specimens to be apparently well preserved and layer 2 specimens to be of poor preservation (Table 2). Δ_{47} temperatures of layer 2 specimens are 44.8 ± 1.0°C on the Caltech biogenic calibration line, layer 4 specimens are 37.6 ± 1.9°C, again supporting a difference in preservation between layers. As discussed previously a difference in preservation is potentially also related to the fact that layer 4 eggshells may represent a related but different species of titanosaurid dinosaur which also makes it likely that the local environment and conditions of preservation could well also be somewhat different (GGG, unpublished observations).

In conclusion we find no clear evidence for significant diagenesis of Auca Mahuevo layer 4 specimens and we consider them apparently well preserved, whereas trace element and petrographic data suggest worse preservation of layer 2 specimens and so we consider them poorly preserved".

Preservation of specimens from the Provence Basin, France

As has been noted previously, the isotopic composition of eggshells between Rousset level A[18] are markedly different from eggshells from Rousset levels C-D and the Roques Hautes section (Supplementary Table 3; Supplementary Figure 6). The Rousset A isotopic values from our study were similar to those reported by Folinsbee et al. 1970[50]. $\delta^{13}C$ values for level A eggshells are ~3 to 4‰ lighter than levels C-D and the Roques Hautes eggshells. $\delta^{18}O$ values for level A eggshells are roughly 5-7‰ heavier than the other samples from Provence that we measured. Offsets between the $\delta^{18}O$ of eggshells and soil carbonate nodules in the Roques Hautes section have previously been noted and interpreted to indicate that eggshells are still recording primary information of paleoenvironment and paleoecology[19]. In our dataset, this offset is not so apparent as two Roques Hautes eggshells have a $\delta^{18}O$ value of -4.3‰ (V-PDB) compared to soil carbonate values averaging -4.9‰. Although Roques Hautes eggshell FR94_031_RH.1 has a $\delta^{18}O$ of -1.7‰, it yielded a Δ_{47} temperature of over 50°C and so is presumably altered (Supplementary Figure 6). We note that all Rousset eggshells from levels C-D have a very similar isotopic composition to the roughly contemporaneous soil carbonates from Roques Hautes; the average $\delta^{18}O$ of Rousset C-D eggshells of -4.7‰ is identical to that of Roques Hautes soil carbonates. Average water $\delta^{18}O$ for Rousset A eggshells are enriched (~6.9‰) compared to soil carbonates from Roques Hautes (0‰). Eggshells from Rousset C-D (0.6‰) are similar to the Roques Hautes soil carbonates, and the eggshells from Roques Hautes have intermediate values that may be consistent with partial alteration (3.2‰).

We note that an alternative interpretation has been proposed to explain differences in eggshell $\delta^{18}O$ observed in the region. According to the model of paleoecology proposed by Cojan et al., 2003[19], the offsets they observed reflect either isotopic enrichments in eggshells compared to soil carbonate within the same floodplain environment, or a difference between eggshells from a channel belt environment and floodplain. In one part of the section studied by Cojan et al. eggshells with similar isotopic compositions to soil carbonates do occur, which was interpreted to be the result of a climatic shift [19].

Thus, what we are observing in the specimens measured in this study either represents a dramatic shift in climate and/or diet and source of drinking water[19], or reflects localized differences in the preservation of eggshells. As we do not observe these offsets between most eggshells and soil carbonates clearly in our dataset, and given our petrographic observations (described below), we conservatively assume that specimen preservation is questionable when eggshells and soil carbonates yield similar isotopic compositions. The notable exception to this pattern are Rousset level A eggshells which show distinct $\delta^{13}C$ and $\delta^{18}O$ values (Table 2; Supplementary Figure 6). It is important to note that the comparison between soil carbonates and eggshells is most relevant to diagnosing diagenesis for the Roques Hautes eggshells as they are recovered from the same strata.

Trace element contents of these samples show that Roques Hautes soil carbonates are often high in iron, manganese, and lithium compared to eggshells, but are much lower in strontium (Supplementary Table 3; Supplementary Figure 6). Many Rousset level C-D, and Roques Hautes eggshells are also found to have elevated levels iron, manganese, and lithium and reduced strontium compared to Rousset level A specimens (Supplementary Table 3; Supplementary Figure 5), consistent with our diagenetic interpretation (i.e., altered eggshells having moved “towards” the composition of the soil carbonates). A possible interpretation of these data is that diagenesis of Provence basin eggshells tends to be associated with loss of strontium but gain of iron, manganese, and lithium.

Petrographic and EBSD analysis of Rousset eggshells yield a more complex picture. Previously published petrographic work on eggshell microstructures from the Provence Basin have variously called for little evidence of recrystallization[18] or highly variable levels of preservation[19,51]. The specimens we analyzed exhibit variable preservation (Supplementary Figure 3). A minority of Rousset C-D specimens exhibited evidence for pervasive diagenesis in the form of fluorescence under cathodoluminescence (Supplementary Figure 3). Generally, however, petrographic, SEM, and EDS, analyses yield evidence for the bulk of the eggshell structure being intact, but with secondary calcite infilling pore canals and blocky secondary calcite frequently being found on the underside of the eggshell surrounding calcite nucleation centers (Supplementary Figure 3). The Rousset A eggshells we examined showed common petrographic features with other Provence basin specimens in that they have calcite infilling of pore canals, localized areas fluorescence under cathodoluminescence analysis, and some blocky calcite on the inner surface of the eggshell (Supplementary Figure 3). Therefore unlike Auca Mahuevo layer 2 and 4 eggshells, our petrographic analysis of Rousset specimens did not provide clear support for differences in preservation between stratigraphic layers, even though clear geochemical distinctions exist.

EBSD analysis yielded important information on the preservation of Rousset A eggshells, where we found the two specimens analyzed to be recrystallized (Figure 4, Supplementary Figure 7), with low-diffracting microcrystalline calcite apparently replacing the original eggshell microstructure. In contrast, some Rousset level C-D eggshells exhibited good preservation by EBSD (Supplementary Figure 7).

In conclusion, we consider Rousset level C-D of uncertain preservation. This was due to variable preservation between specimens being observed by petrographic and EBSD analysis of sections but specimens proving geochemically similar, a possible indication of variable preservation even within the same eggshell fragment. Isotopic evidence that eggshells were similar in composition to soil carbonates plus petrographic analysis lead to us to consider Roques Hautes eggshells of poor preservation. Stable isotope and trace element geochemistry clearly indicate a significant difference in the composition of Rousset level A eggshells specimens. This appears reflect a localized difference in taphonomy as EBSD analysis suggests that Rousset A may be more recrystallized than other layers.

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